FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2514 Vol 71 FRIDAY 29 MARCH 1957

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67 Yonge Street
Telephone · Empire 6-0873

New York 6, N.Y.
Thomas Skinner and Co. (Publishers), Ltd.
111 Broadway
Telephone · Digby 9-1197

SUBSCRIPTION RATES
Home and Overseas · Twelve Months, £4 10s. U.S.A. and Canada, $14.00

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Service Airlift

WHATEVER gloom may be cast by the Air Estimates, it can hardly cloud the outlook for R.A.F. Transport Command. A report on page 403 bears witness that de Havilland Comet 2s have placed the Command squarely ahead of any similar formation; and the lead will be held until, some months hence, the KC-135s become operational in the U.S.A.F. Even then the 480-m.p.h. Comets will remain unchallenged in respect of field performance, as their current operations testify. That the ten Comet 2s already acquired will eventually be joined by later, larger machines of the same family is an entirely reasonable expectation. Bulkier, heavier loads will be lifted over longer ranges, at a speed only 80 m.p.h. less, by a fleet of thirteen Bristol Britannia 253s, to be delivered from the autumn onwards; and further Britannias may yet be procured. As a short/medium-range load-lifter and heavy-dropper the Blackburn Beverley makes its own massive contribution to the mounting strength of the Command, and faster (turboprop) versions are already seen as glints in Blackburn eyes. Just how developments in this direction might affect the R.A.F.'s expected adoption of the A.W.660 is not yet clear; but in any case, the Army will be getting the rear-loading, heavy-dropping facilities it has yearned for over the years. As their STOL/VTOL assault transports they will have Scottish Aviation Twin Pioneers and Bristol 192s, while the possibilities for their purpose of the Fairey Rotodyne and Westland Westminster are, of course, immense.

This is by no means the whole picture. Overseas interest in our military transports is wide and earnest; and while British-built Comets and Britannias may never bear the insignia of other forces than our own (though the Canadian-built Britannia is likely to be adopted by at least one Service) the export possibilities of the Twin Pioneer and A.W.660 are already distinct. The Twin Pioneer, in particular, is being evaluated by the U.S. Army, as, indeed, is the Franco-British HDM.107, subject of news in this issue; and the recent U.S. Army contract for D.H. Canada Caribous, following massive orders for Beavers and Otters, puts a further highlight on an ever-brightening picture.

Quiet Epic

OVER the snowy wastes and glacial hills of northern Antarctica an important work of aerial survey has been in progress which—perhaps because of the more-publicized International Geophysical Year activities to the south, or perhaps just because of its quiet efficiency—has gained comparatively little publicity. Yet the report which John Saffery sent home recently on the season's work the Hunting Aerial Survey Expedition has just completed in Graham Land—which we illustrate on p. 409 (and which was the subject of an "All Quarters" item last week)—makes it quite clear that what has been achieved, in photographing 40,000 square miles of that territory from the air, is little short of an epic accomplishment by both the aircrews and the ground surveyors.

From a casual glance at the map, Graham Land looks but a tiny area against the vast white expanse of Antarctica; but in fact, when seen by the crews of the patient photographic Cansos doing hour after hour of careful coverage, it forms a limitless snowy expanse—upon which the chances of survival after a forced landing would be slim indeed.

This work of scientific skill, done under conditions which are the hardest Nature can provide, is the logical conclusion to the historic explorations of Shackleton, Amundsen, Scott and Admiral Byrd—whose untimely death, after being named overall head of Operation Deep Freeze—we recorded last week. It is fitting that Saffery and his colleagues should have been awarded the Johnstone Trophy for this year's most outstanding navigational feat; and it is right, too, that we should recognize publicly that their work is not merely routine, unexciting and scientific, but a splendid compound of adventurousness, skill and courage—great things in days when fame too often comes cheaply from the TV quiz or rock 'n' roll record.

FROM ALL QUARTERS

A New Defence Pattern

NEVER have Britain's armed forces faced such drastic revision as they do today. The whole concept of global strategy, local tactics, weapons, administration and manning have been shaken up, and, following the (successful) outcome of the "Summit" talks at Bermuda, will duly—if belatedly—be published as the White Paper on Defence and the Service Estimates.

The most significant single factor to emerge from the Bermuda discussions is that the U.S.A. will supply intermediate-range ballistic missiles—possibly Thor (Air Force), Jupiter C (Army) or Polaris (Navy)—for use by British forces. All three weapons should be ready for production delivery by the autumn of 1958—well ahead of any equivalent British weapon (English Electric, de Havilland and Rolls-Royce have been named as interested in this field). American forces will, it is reported, retain nuclear warheads for these weapons; they will not be made available except in emergency.

Britain should be virtually self-sufficient in the fields of air-to-air and surface-to-air weapons, which have not been publicly mentioned in connection with the Bermuda talks.

In a Parliamentary written reply last Monday Mr. Aubrey Jones, Minister of Supply, said he had accepted in principle the recommendations of the Select Committee of Estimates for the selective allocation of contracts in the aircraft industry. Until the Defence Statement was published it was impossible to indicate its full implications. To maintain the prosperity of the industry the reduction should be offset as much as possible by increased civil and export work.

The Engineering Strike

AIRCRAFT factories reported to be affected in greater or lesser degree by the engineering strike which began last Saturday included those of the Bristol Aeroplane Co., Short and Harland, English Electric, de Havilland (Chester and Christchurch, Hants, works), and A. V. Roe. Rolls-Royce Avon production in Scotland was also affected.

A Civil Victor?

REVIEWING Handley Page activities during 1956, the chairman, Sir Frederick Handley Page, recalls that in 1952 the company offered B.O.A.C. a transport development of the Victor. Designated H.P.97, it would have carried more than a hundred passengers non-stop between London and New York "at speeds similar to those of forthcoming American jetliners," and could have entered service well before the American machines. In 1952 B.O.A.C. saw no need for such an aircraft, though today the "new executive" is showing interest in a more advanced development. [Sir Miles Thomas, B.O.A.C. chairman in 1952, comments that the original offer was never accompanied by guaranteed performance data, and that, had the machine been ordered, a great deal of public money would have been pledged to an untried project.]

Sir Frederick considers it unfortunate that the initiative in boundary-layer control appears to have crossed the Atlantic. In association with several other British constructors, his company is investigating the design of a supersonic civil transport.

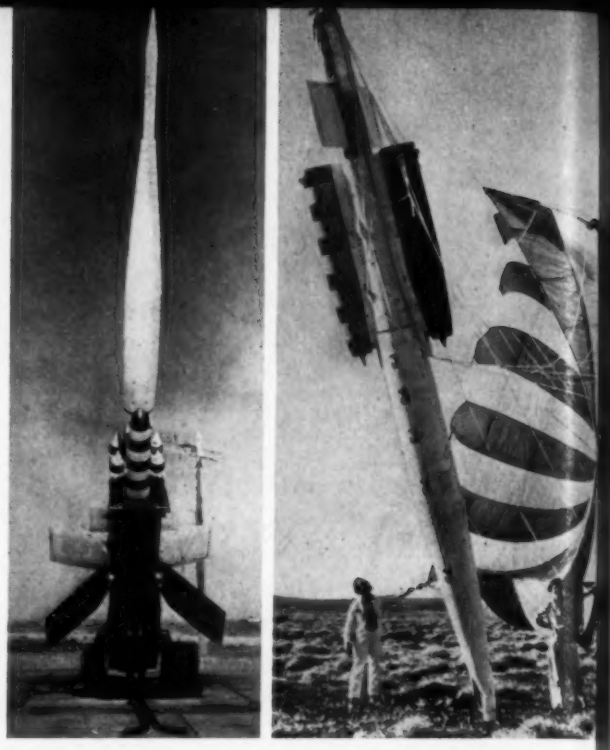
Bristol's Bobbin

ILLUSTRATED on this page is the Bobbin, one of the early test vehicles used in the development of the Thor ramjet and an associated ground-to-air guided weapon. All three components—vehicle, engine and weapons system—are the prime responsibility of the Bristol Aeroplane Company.

According to Bristol, Bobbin was the first British recoverable test vehicle of this nature, and also the first British application of supersonic parachutes. The latter established the vehicle in a stabilized descent pointing directly downwards, so that Bobbin's nose spike could arrest the fall smoothly on reaching the ground.

Tests on the long nose-spike were carried out by using a dummy vehicle which was dropped vertically from a crane, hitting the ground at the correct velocity. Decelerometers and high-speed cameras recorded the impact deceleration. To find out how the spike would react to various types of terrain, half-scale models of Bobbin were dropped from a Sycamore at various places over the Woomera Range in South Australia.

Parachutes for Bobbin were developed by the British Irvin and G.Q. companies. For deceleration tests, a full-weight dummy test vehicle was dropped from a Canberra at very high altitude over Salisbury Plain. The dummy accelerated in free fall to well above the speed of sound—producing an admirable supersonic bang—



BOBBIN is the code-name of this test vehicle by the Bristol Aeroplane Company (see news item below). Powered by twin Thor ramjets, and boosted at launching by four rocket motors, it is recovered by parachute.

and six ribbon parachutes were deployed by a time switch. After initial deceleration to a moderate subsonic speed, an explosive charge released the small parachutes, which, in falling behind, drew out the main 30ft nylon canopy. In practice it was found that the latter invariably reduced the rate of descent to a value commensurate with complete recovery.

As the photographs show, Bobbin is powered by twin 16in Thor ramjets (*Flight*, August 10, 1956). These are mounted above and below the body, separated from the latter only by a small boundary-layer diverter. The body is assembled from tubular sections housing kerosine, instrumentation and probably the fuel pumps. Ramjet ignition is by means of strontium flares, and Bobbin is launched by four wrap-round rocket boost motors, each of which has a large, swept fin. The basic vehicle has no control surfaces and only a diminutive rectangular wing of trapezoidal section. Overall length is at least 35ft.

It is not permissible to enlarge on the similarity of Bobbin to the Bristol ramjet-driven anti-aircraft missile, but it can be stated that the test vehicle has "contributed substantially" to the latter's development. Moreover, Mr. Peter Masefield, managing director of Bristol Aircraft, has commented: "I want to stress that Bobbin is only one of the many types of test vehicle we have built at Bristol. We now have a very considerable proportion of our design and working forces engaged in this guided-weapon field and the tremendous programme of testing which we have undertaken has resulted in the successful development of an entirely practical weapons system."

H. E. Chaplin Steps Down

ON medical advice, Mr. H. E. Chaplin has relinquished his appointment as chief designer to the Fairey Aviation Co., Ltd. He has, however, agreed to act as design consultant to the technical director and chief engineer, Mr. R. L. Lickley, and to Mr. L. R. E. Appleton, head of guided-weapon design and development. He will be based at White Waltham.

Mr. Chaplin.

Inevitably known in the industry as "Charlie" Chaplin, Herbert Eugene Chaplin, M.B.E., M.I.Mech.E., F.R.Ae.S., M.S.A.E., has been designing aircraft for forty years. Having been discharged from the R.F.C. on medical grounds in 1917, at the age of 21, he joined George Parnall and Sons, Ltd., as a draughtsman, under the late Harold Bolas. He remained with Parnall—latterly as senior designer draughtsman—for over ten years, except for a break of a year when the company was reorganized. During this period he worked on some uncommonly interesting aircraft, including the Puffin biplane, Possum

UKRAINA: Named after the Russian province in which it was designed and built, Antonov's AN-10 is a 120,000 lb machine designed for operation from short, unprepared strips. It is powered by four 4,000 h.p. turboprops and uses a wing similar to that of the twin-engined AN-8. The "Flight" three-view drawing is provisional; a description appears on p. 425.

triplane, Perch naval trainer, Pike deck-landing bomber/reconnaissance aircraft, Peto submarine-borne reconnaissance machine, Plover fleet fighter, Pixie light aircraft, two types of autogiro, and the Imp private-owner biplane.

Such was the outlook for the British aircraft industry in November 1929 that Mr. Chaplin left Parnall to join Bolas in the U.S.A. The move, however, coincided with the Wall Street subsidence, and in April 1930 he returned to join the Fairey company as senior draughtsman. He worked on the Firefly intercepter biplane, the S.9/30, the G.4/31, the Battle, the Albacore and the Firefly naval monoplane. When the Firefly I was completed, in 1943, he was given charge of a project design team. He produced several ideas in connection with full-span flaps and investigated the problems of building laminar-flow wings. His, likewise, was a scheme for fitting two engines in tandem, with shaft drive to independent halves of co-axial propellers—an idea that materialized in the Armstrong Siddeley Double Mamba for the Gannet. In 1947 the Navy's "mat-landing" scheme prompted him to propose the vertical launching of a twin-Avon fighter. Although the Air Ministry were interested, they were concerned at the cost, and Mr. Chaplin then proposed a "pilot" project, using a single Nene. This idea eventually materialized as the F.D.1, with a Derwent. Thereafter Fairey were asked to study supersonic flight, and Mr. Chaplin was a leading member of the team which produced the record-holding F.D.2.

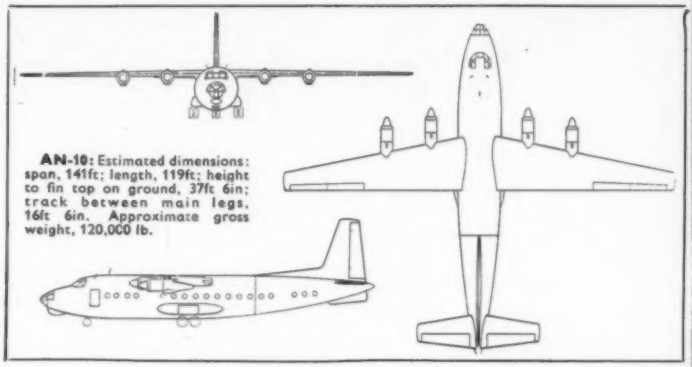
New Djinn Record

LAST Friday, March 22, a Sud-Aviation Djinn helicopter (Turboméca Palouste turbine), flown by Jean Dabos with Jean Castagne as engineer, reached 8,482 m (27,829ft)—subject to official homologation, a world record for rotary-wing machines. The previous best figure was 26,744ft by an Alouette.

Hunting's Royal Visitor

ON March 12 Prince Philip visited the Hunting Group's three survey and development companies at Elstree. Accompanied by his equerry, S/L. H. M. Chinnery, he was welcomed at noon by the group chairman, Mr. P. Ll. Hunting, the chairman, Mr. C. P. M. Hunting, and the managing director, Mr. F. L. Wills.

Prince Philip toured the laboratories of Hunting Aerosurveys and examined a display of airborne mineral survey equipment used by Hunting Geophysics and Hunting Technical Services. This included the magnetometer for sub-surface geological structure mapping; the electromagnetic detector, employed for the direct detection of conducting sulphide ore bodies; and the scintillation counter, used in surveys for radioactive ores. He then inspected the newly opened laboratories and watched work in progress (including photogeological interpretation, and the reduction and interpretation of airborne geophysical data).



AN-10: Estimated dimensions: span, 141ft; length, 119ft; height to fin top on ground, 37ft 6in; track between main legs, 16ft 6in. Approximate gross weight, 120,000 lb.

Avro Canada Acquire P.S.C.

SIMULTANEOUS announcements in London and Toronto on Thursday of last week gave the news that PSC Applied Research, Ltd., of Toronto, have been acquired from the Hunting Canadian Group by A. V. Roe, Canada.

PSC, specialists in electrical and mechanical instruments primarily of aeronautical application, were founded some six years ago and have two factories in Toronto. Apart from such airsurvey equipment as cameras, magnetometers and airborne profile-recorders, and a variety of missile equipment, perhaps their best known product is the R-Theta computer now in quantity production for the R.C.A.F.

More Indian Austers

A FURTHER quantity of Auster A.O.P.9 light observation aircraft is to be supplied to the Indian Government. The order, which, including spares, exceeds £250,000, follows the supply last year of ten similar machines. The new A.O.P.9s will serve both with the Indian Air Force and Army.

Burtonwood Not Closing

CONTRARY to a report from Washington (*Flight*, March 1) the U.S. Air Force is not going to close down its Northern Air Materiel Area depot at Burtonwood, Lancs. All that is happening is that administrative and field supervisory responsibilities for Europe are being concentrated at Central A.M.A., Chateauroux, France. This is a "paper" change only.

Miles HDM.107

ALTHOUGH F. G. Miles, Ltd., of Shoreham Airport, have made no announcement regarding the HDM.107, certain details of this promising project have leaked out in America.

Basically the 107 is an advanced, higher-performance derivative of the HDM.106, with a slight increase in dimensions and weights. Powered by two Lycoming T53 turboprops, each rated at 808 s.h.p., the 107 is intended to lift 15 passengers or 3,000 lb. of freight out of modest fields. It is currently being evaluated by the U.S. Army as an assault transport.

The published data include the following: span, 80ft; length, 38ft 6in; height, 16ft; freight volume, 563 cu ft; empty weight, 4,940 lb; gross weight, 9,500 lb; fuel capacity, 360 U.S. gal (300 Imp. gal); sea-level climb, 4,170ft/min (or 1,490ft/min with one engine out); level cruise at 54 per cent rated power, 173 m.p.h.

ELECTRONIC METERING: A. Cdre. N. A. Tait, O.B.E., Director of Aircraft Engineering, Air Ministry, is seen (right) with Mr. Stanley Goss, general sales manager of Simmonds Aerocessories, Ltd., on a recent visit to the company's Treforest works. The air commodore inspected the new Simmonds electronic flowmeter, specified for the Sea Vixen and Scimitar and for retrospective installation in Sea Venoms and a number of other aircraft.

OPERATION SOUTHERN CROSS

No. 224 Squadron's Tour of South America

"FLIGHT" PHOTOGRAPHS

As briefly announced in *Flight* of March 15, four Coastal Command Avro Shackletons of No. 224 Squadron left Gibraltar on the morning of March 16 for a goodwill mission to South America. In the 34 days devoted to the flight ten countries are being visited and 16,171 miles travelled. The time schedule allows for the aircraft arriving at the various stopping-places on the following dates: March 16, Dakar (French West Africa); March 17, Recife (Brazil); March 18, Rio de Janeiro (Brazil); March 22, Montevideo (Uruguay); March 25, Buenos Aires (Argentina); March 29, Santiago (Chile); April 2, Lima (Peru); April 6, Guayaquil (Ecuador); April 10, Key West (Florida); April 13, Bermuda; April 17, Azores; April 18, Gibraltar.

The Shackletons have had their mid-upper turrets removed and blanking plates fitted, thus providing a good deal more space in the fuselage—a desirable modification, as each aircraft is carrying no fewer than 21 passengers and crew.

All legs of the journey are well within the Shackletons' range (2,700 miles with 3,492 gal of fuel), the longest being 2,100 miles between Bermuda and the Azores. The full 25 lb boost available with water/methanol—giving 2,500 h.p. for each Griffon—will be required for take-off from Quito, Ecuador, where the airfield is at 10,000ft. Only two aircraft are visiting Quito, and a full load of fuel will not be necessary for the short (170-mile) journey from Guayaquil.

Ground crews and spares are being carried in the four aircraft, either in the fuselage or in special carriers in the bomb-bays. There is, therefore, no attendant Hastings of Transport Command as is usual on such missions. The spares will not include an engine, but one is being held in readiness at Gibraltar and will, if needed, be flown out by the reserve Shackleton. Since long mileages have to be flown over water, a complete set of Lindholme ditching gear is carried, and each aircraft has three Sarah transmitters complete with a reserve supply of batteries.

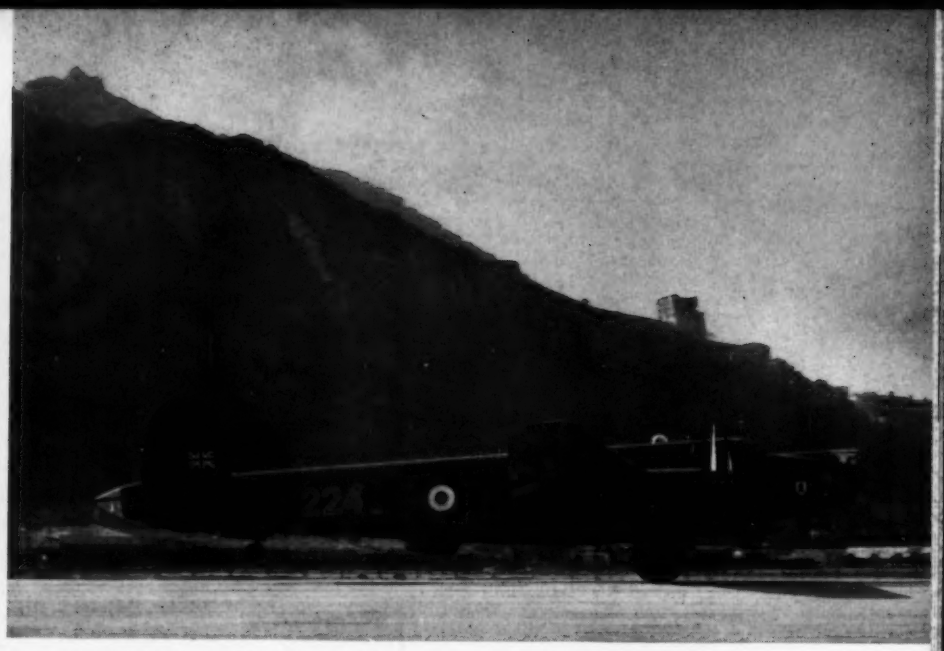
In command of the mission is A. Cdre. J. D. Miller, C.B.E., who, since January last year, has been Air Officer Commanding, Gibraltar; his Senior Air Staff Officer, W/C. E. F. J. O'Doire, D.F.C., A.F.C., is Deputy Commander. W/C. G. E. Willis, D.F.C., A.F.C., commands No. 224 Squadron.

The squadron is at the top of its form. As recorded in *Flight* of March 1, it won the recent Coastal Command photographic competition and in 1956 it was awarded the Coastal Command Squadron Efficiency Trophy. In the realm of sport, too, No. 224 has won both the Coastal Command Pentathlon and Aird Whyte swimming trophies.

After serving as part of a Royal Naval Air Service wing at Otranto in Southern Italy, No. 224 came into being with the formation of the Royal Air Force on April 1, 1918, and it is because of this association with Otranto that the arms of that town are incorporated in the unit's badge. Its motto is *Fidele All' Amico* ("Faithful to our friends").

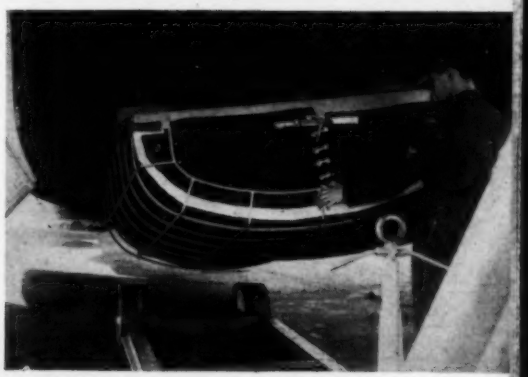
The Squadron's record in the 1939–45 war was one of continued effort against enemy submarines wherever they were to be found—in the North Sea, the Bay of Biscay or far out in the Atlantic. At first with Hudsons and later with Liberators, the aircrews fought out this bitter struggle—a battle on the outcome of which depended the ability of this country and our allies to maintain supplies to continue the war. To the squadron goes the distinction of having sunk two submarines with one aircraft—and within 22 minutes. For this moonlight adventure F/O. K. O. Moore, a Liberator captain, received an immediate award of the D.S.O. No. 224 was credited with sinking 11 U-boats. J.Y.

Just before the start: Three of the No. 224 Sqn. Shackletons lined up on North Front airfield in front of "The Rock."



(Left) A. Cdre. J. D. Miller, C.B.E., Force Commander and A.O.C. Gibraltar. (Right) No. 4 Shackleton (WL753), piloted by F/L. A. P. Bluett, D.F.C., becoming airborne after passing over "Spanish Road," which runs through the neutral zone and joins Gibraltar to Spain. The runway extension is here built out to sea for over half a mile.

(Left) F/L. P. Cowieson, Squadron Navigation Leader, enters No. 4 aircraft. (Centre) Final smartening-up for the squadron badge. (Right), G/C. A. F. Johnson, D.F.C., Station Commander, Gibraltar (on right) talks with W/C. G. E. Willis, D.F.C., A.F.C., before take-off.



Winching an equipment pannier into the bomb-bay of one of the Shackletons. Spare wheels were carried in the bomb-bays, independently of the panniers.

The C.O. and his senior captains: (l. to r.) F/L. O. A. Cussen, D.F.C.; S/L. R. P. Flood; W/C. G. E. Willis, D.F.C., A.F.C.; F/L. N. Allsop; F/L. A. P. Bluett, D.F.C.

Problems of Jet Transport Operation

An Appraisal by T.C.A.

PART I

"Flight" photograph

A T.C.A. Viscount 724. The airline's chief engineer, Mr. Jack Dyment, discusses in the text the problems ahead—with particular reference to big jets.

FOR 18 months past we have recorded the solemn warnings of the world's civil aviation organizations about this or that aspect of forthcoming jet operations. Here we publish abstracts from the most concise appraisal of the problem yet made. It is a paper by Mr. J. T. Dyment, chief engineer of Trans-Canada Airlines, read last week before the Weybridge and London Airport branches of the Royal Aeronautical Society. It is given especial topicality by the I.C.A.O. airports symposium now in session at Montreal.

Let us first summarize, said the lecturer, a few of the major differences between the transports we expect to operate in 1960 and the transports most of us are using today.

Speed: The new jets will cruise at speeds between 550 and 600 m.p.h. compared with current speeds of between 325 and 350 m.p.h. This feature alone creates a host of new problems in traffic control, communications, cockpit design, etc. *Fuel:* The new jet transports will consume fuel at a rate between 10,000 and 15,000 lb/hr compared with 2,000 to 3,000 lb/hr for current reciprocating engined aeroplanes. *Noise:* Relative noise-level of a free-jet engine will be about 120 db compared with 110 db for a reciprocating engine under similar conditions. *Take-off:* Power available from the jet engine falls off much more rapidly than from a reciprocating engine as the ambient air temperature rises. It is generally not obvious by feel that an engine is not producing its full thrust. *Cruising:* Since the jet engine is so sensitive in fuel consumption to any departure from the ideal operating condition, it is desirable that the aeroplane always be flown at as high an altitude as possible compatible with its weight and the prevailing ambient air temperature. *Landing:* The pure-jet aeroplane to date has had nothing comparable to a propeller to assist the wheel brakes in stopping it quickly during a landing. *Rotating Parts:* Because of the magnitude of the harnessed energy in the turbine and compressor wheels when rotating at speeds of 15,000 r.p.m., they must be treated throughout their service life with even more respect than has been necessary with components of reciprocating engines to avoid failures. *Size:* With the increased power available from turbine engines, the weight of transports will be double that of today (300,000 lb *v.* 140,000 lb) and there will be almost twice as many passengers to look after for each flight (122 *v.* 63, 140 *v.* 74, etc.). The size also permits sufficient fuel to be carried to enable the North Atlantic region to be operated non-stop between major cities.

The Airport. In addition to stronger and slightly longer runways at many airports, there will have to be a wider use of concrete. It is desirable, for ruggedness and clearness of markings, that the first thousand feet of each runway be concrete. Concrete is also required at refuelling points and at ramps (aprons) where fuel spillage might occur and damage asphalt base surfaces. It should at the same time be mandatory for all turbine powerplants to be equipped with a reservoir to catch fuel spillage from the engine itself.

More adequate house-cleaning equipment will have to be provided than is now generally used; airport authorities will have to maintain a continual policing of runways, taxi-ways and the ramp, to prevent foreign objects or loose sand on the surfaces being sucked up or thrown into a turbine engine. It is not practical to equip the engines with intake screens.

The handling of snow and ice will require considerable thought. Application of hot sand to an icy surface will no longer be a desirable procedure, nor will the continued application of calcium chloride be likely to be accepted by the airlines. The absence of propellers has permitted smaller ground clearances, so even more corrosion will be experienced with under-surfaces unless airports are prohibited from using corrosive salts.

The increased final approach speed of jet aeroplanes accentuates the need for improvements in the visual aids which have already been requested for current aeroplanes. The better the aids, the lower may be the safe visibility limits, and hence the better the regularity of the service. The approach, threshold, and runway should be treated in such contrasting fashion that at no time could one be mistaken for the other two whether visible or not. Identification must be instantaneous and instinctive. Complete agreement as to the best way of accomplishing this has not yet been reached, but all agree that the basic requirements include identification; alignment; roll guidance; height guidance; distance and positive definition.

Since an aeroplane makes money only as long as it is flying, effort should be made to shorten the *en route* stop time and turn-around time. A parking area is, therefore, needed near the ramp, with the ability for the airline to do servicing not requiring the running of engines at this point. At the present time, at some airports, over an hour is lost in taking the aeroplane to its servicing point and returning it. Servicing requiring the running of engines should still be done as close as practicable to the ramp as determined by the effectiveness of service noise suppressors.

With turbine engines, speeds of 2,000 to 3,000 r.p.m. are required before the engine is self-sustaining, and at these speeds the compressor is absorbing an enormous amount of power. Electrical starters can be used up to a point, but they demand extremely high-powered ground units. On the larger engines pneumatic starting has been found to be the most practical.

The problem is: which is the best way to provide a large volume of high-pressure, high-temperature air? An auxiliary turbine unit would appear to be the logical choice, but existing turbine starting units are noisy and a nuisance on the ramp. Perhaps a hydrant system could be used at the larger airports, but the development of adequate silencers will still be necessary to permit the general use of turbine starters.

Because of the high rate of fuelling required (over 800 Imperial gal/min) for the new big transports, and the desire to avoid using large vehicles on the ramp, fixed fuelling hydrants are necessary. Similarly, to hold the number of vehicles required on the ramp to a minimum, fixed facilities are also desired to provide electricity, conditioned air, compressed air, and sewage disposal.

Because of the high fuel consumption of a jet aeroplane during taxying and idling (up to 10,000 lb/hr), the airport layout should be such that taxying time will be held to a minimum. Access to the most used runway should require the least taxi time. It is desirable to have high speed turns-off and turns-in, in order to clear runways as quickly as possible for other aircraft landing or taking off. To permit this, a taxiway turn radius of around 750ft should be satisfactory.

Although taxiway by-pass areas are needed today to permit an aeroplane held up for any reason to stand off the taxiway, it is even more important that they be available in time for jet aeroplane operations.

Because the outboard engines of the big new transports will extend beyond the normal 75ft-wide taxiways, some means must be evolved, whether it be a hard surface or a tough type of grass, to prevent erosion at the sides of the taxiways and to prevent damage that might result to an engine of a following aeroplane from the lifting of debris or dirt.

At the present time, it is believed that blast fences 10 to 15ft high might be required on the ramp behind which personnel can slip (as does a bullfighter in a ring) for protection against jet blast and noise when high power is used by the aeroplane to start it moving. The break-away thrust requires around 80 per cent

maximum r.p.m. Apart from these few moments when the aeroplane first starts rolling, no real problem is expected from either blast or heat from jet engines in civil transports.

Because the new transports will be carrying around 120 to 140 passengers, and because several aeroplanes can arrive or leave almost simultaneously, the entire passenger handling procedure and accommodations are in great need of review.

Millions of dollars are being spent to reduce the time it takes to fly from one airport to another, but relatively little progress has been made to date to reduce the time it takes between leaving one's home or office and sitting in the aeroplane. It has been said that we are living in a wonderfully progressive age. "We'll soon be able to fly from any place in the world to any other place in almost the same time as it takes to go to and from the airport."

Providing through-ways or super-highways from downtown to the airport, or relocating the airport to be on such highways, can be a fabulously costly business. Only long-range planning can solve the problem of transportation time to and from airports.

A great deal can be done to speed up the handling of passengers through an airport. This could begin with how to best handle the aeroplane and its load on the ramp. Jet aeroplanes can be handled in exactly the same manner as reciprocating-engined aeroplanes—that is, they can taxi in under their own power, turn around, come to a stop, discharge passengers and cargo as today, be serviced, reload and taxi away under their own power. There might be a better and faster way of doing these things.

One view is that the aeroplane should taxi to the vicinity of the ramp, stop its engines, and then be towed into a dock position, serviced and towed out to a particular spot where the engines could be started and the aeroplane taxi away. This method would result in a minimum of noise at the ramp, but it could be too slow unless better means of handling large aeroplanes are devised than exist today. The lack of traction when towing on a slippery surface accentuates the problem. Even under non-icing conditions the tractor would have to weigh around 30,000 to 40,000 lb and have a draw-bar pull between 20,000 and 30,000 lb .

Another suggestion that merits considerable study is that the aeroplane should taxi directly into a nose dock with about 6ft clearance all around. Movable covered extensions from the fixed ramp or dock would bridge the clearance to the aeroplane's doorway. The aeroplane could then discharge its passengers or embark them under cover and without steps. Fixed servicing facilities could all be established so that there would be a minimum of hose lines, connecting electrical lines, etc. The aeroplane could be drawn back from the dock by a quickly connectable cable attached to a fixed capstan in the ramp or to a power-driven capstan on a truck which itself could be quickly anchored to a fixed position on the ramp. The engines could be started either at the dock or after the aeroplane is pulled back. It would only be pulled back until it had sufficient room to turn and taxi away under its own power.

Another suggestion is that the aeroplane would be stopped as convenient a short distance from the passenger terminal and a long telescopic covered bridge or marquee would then move out to the aeroplane for the use of the passengers. A conveyor belt system would move into place for the loading and unloading of cargo. This method is likely to be more costly than others suggested and the marquee and conveyor belt would restrict the free movement of vehicles around the aeroplane.

(*To be continued*)

RAY OF HOPE FOR PRIVATE PILOTS?

ALTHOUGH the trials and tribulations of private flying clubs have never been regarded by our legislators as a major pre-occupation, it must be conceded that the brief adjournment debate—on the necessity for encouraging private flying—initiated last Friday by Mr. Frank Beswick (Lab., Uxbridge) produced an uncommonly rewarding response from the Government Front Bench.

In his reply—a first solo as Parliamentary Secretary to the Ministry of Transport and Civil Aviation—Mr. Airey Neave was able to announce that it had been agreed to make a further 60 R.A.F. airfields available to private flying, and to give an assurance that his Department would look sympathetically at any proposal for "a smaller and cheaper aircraft to replace the Tiger Moth."

MR. BESWICK opened the debate with some general remarks on the need for "a national atmosphere of air-mindedness," then went on to the detailed problem of airfields. Perhaps echoing a recent article in *Flight*, he pointed out that there was going to be a particular need for another aerodrome in the London area when Croydon was closed in 1958. The obvious possibility was Hendon. Another possibility was the use of a grass strip at Gatwick, such as already existed at New York, Dusseldorf and Hanover.

Turning to the question of abandoned R.A.F. airfields, Mr. Beswick suggested that there were some areas—for example, East Anglia—where the light aircraft would become feasible as a vehicle of transport if these old bomber aerodromes were available for private fliers. At present, a pilot who made a landing on an unauthorized aerodrome found himself liable to a fine of £200.

In a diversion towards the question of the recruitment of airline pilots Mr. Beswick said it was obvious that the Service was ceasing to be a reliable source. The last-war intake was now coming to the end of the line. One possibility was the adoption of a scheme such as that suggested by the Air League.

Dealing with the question of "discrimination" against the private pilot—as distinct from the flying club—on such matters as landing facilities and fuel tax, Mr. Beswick went on to give comparative figures as between Britain and America. In the United States there were now 21,500 business aircraft in operation, over 19,000 of them single-engined machines—seventeen times the number of the whole American domestic transport fleet—and between them they flew 903,000,000 miles.

In this country there were 364 business and private aircraft.

In his view, the Government ought to encourage the construction of a private light aircraft for which it would be possible to provide a home market by removing the discrimination against the private owner.

Many ex-members of the R.Aux.A.F. would be prepared to fly their own aircraft at their own expense if they could be given hangarage from aerodromes where they had previously operated.

Mr. Beswick ended with a tribute to private flying organizations and to the parent body, the Royal Aero Club, which, under the active chairmanship of Mr. Kenneth Davies, had done much good work.

W/C. E. B. LUCAS (Con., Brentford and Chiswick) said he believed that private flying lay at the base of all aviation. He recognized the work done by the private flying organizations, but the sad fact was that private flying today was really outside the means of the ordinary person. Nevertheless, it was important to develop an interest in aviation among young people. He thought it a great pity that there did not exist today something like the pre-war Civil Air Guard which, though it operated for only a year, attracted something like 10,000 members and provided about 7,000 aircrew.

MR. AIREY NEAVE, replying to the debate, said that the work done by the flying clubs in the development of air-mindedness was of the highest importance. There were today 140 operational flying clubs in this country compared with about 50 in 1948. That showed how keenness was growing. It was the Minister's aim that his Department should be a source of encouragement and help to the flying clubs and private flying in general.

The total number of airfields available to private fliers was 114, but the Air Ministry were considering widening the scope of the Joint User Scheme, and that applied particularly to individual R.A.F. airfields except where there was some special security feature. It had just been agreed that an additional 60 active R.A.F. airfields would be available on a "prior permission" basis. This meant that the grand total of airfields available to private pilots would shortly be 174.

The number of usable abandoned airfields was diminishing. At the moment there were still 86 under consideration for disposal, after which neither Air Ministry nor M.T.C.A. permission would be required for their use. There were still a number of airfields retained indefinitely as reserve airfields or awaiting decision.

A survey of 60 airfields for casual landings had been made as a result of representations by the R.Ae.C., but it was not found that many were suitable. The matter was still being considered. He had heard complaints that there had been difficulty in obtaining permission for such landings, and this would be avoided as much as possible in future.

Mr. Neave said that the question of aerodromes near London was "rather complicated." There were seven clubs now at Croydon and every effort must be made to find out how these could be fitted in to other airfields. Several other R.A.F. aerodromes were being considered. A limited amount of joint-user flying was available at Hendon, but he could say no more than that further information was expected in a few months' time. He promised to consider the use of a grass airstrip at Gatwick, where some suitable types of aircraft might be fitted in.

He went on to say that the Minister entirely agreed that in present circumstances it was now essential, having regard to the future of military aircraft, to have civil training facilities to supplement the release of pilots from the former source of the R.A.F. He was considering the scheme submitted by the Air League, which was supported by the Corporations and the majority of independent airline companies. Two particular aspects were being examined by the Air Ministry, the M.T.C.A. and the Scottish Education Department: (1) the proposal that there should be exemption from military service and (2) educational grants for theoretical training as distinct from practical. His Department was working with the operators on the draft scheme at the moment, and the Minister had made it quite clear that he wanted the matter dealt with as quickly as possible.

With regard to the working party on pilots' licences, Mr. Neave said this hoped to conclude its task this year, and the whole question of instructors' ratings would also have to be considered.

Mr. Neave then turned to the development of a British light aircraft, and said that this was the first time that the matter had been raised to him. No official body had put forward to him, suggesting official encouragement, something in the nature of a smaller, cheaper aircraft to replace the Tiger Moth. There would be various considerations of public money involved, but the suggestion would be fully examined if it was put up.

He was frankly not convinced about the case for ending discrimination on landing fees and petrol tax between private flier and flying club. His Department did not feel that the private owner of an aircraft which could be used for business was really in the same position as the flying club, which extended to a wide section of the community facilities they could not otherwise afford.

HERE AND THERE

SEA VIXEN Mk 20 is the designation of the fully navalized version of the de Havilland 110. This, the first Mk 20 to emerge from the Christchurch factory, made a successful 36-minute maiden flight on March 20 in the hands of Mr. J. Elliot, Christchurch chief test pilot, with Mr. R. Adams as observer. Powerplants are twin Rolls-Royce Avons of an advanced series.

Japanese-built Neptunes

IN Japan the Defence Board has decided to go ahead with plans for producing Lockheed P2V Neptunes. According to a Tokyo radio report, it was hoped that the U.S. Navy would contribute 65 per cent of the total expenditure, which is estimated at over 40,000 million yen (approximately £40m).

Research Contribution

TWO companies in the A. V. Roe Canada group—Avro Aircraft and Orenda Engines—have jointly given $50,000 (£18,000) to the University of Toronto Institute of Aerophysics to assist its expansion programme.

Air Race Information

THE Aero Club of South Africa has announced dates for the Governor-General's air race. This will be in two stages, from Pretoria to Durban on May 31 and from Durban to Baragwanath (just outside Johannesburg) on June 1. The first prize is £700.

There I Was . . .

A NEW series of weekly B.B.C. television programmes, called *Now* and due to start on April 3, will include live broadcasts of a helicopter flight down the Thames from Westminster to the Port of London, a parachute drop, and a Naval aircraft landing on a carrier at sea.

Shoals Ahead

AN airborne version of the Pye "Fish-finder" was recently tested over the English Channel by Grosvenor Air Charter in a Westland Whirlwind. The equipment in the helicopter was connected by cable to a transducer housed in a bomb-shaped submarine body, which was towed on or just below the surface of the water at speeds up to 50 kt. This method of echo-sounding from the air is likely to have wide application not only in fishing but also in mine-detecting and salvage work.

M.o.S. Appointment

IT was announced last week by the Ministry of Supply that Mr. E. W. Chivers has been appointed Deputy Director of the Armament Research and Development Establishment, with effect from April 1.

Textiles on View

AMONG exhibits at the 2nd Industrial Textiles Trade Fair, being held at the Royal Albert Hall from April 1 to 5, will be aircraft braking parachutes and protective clothing for use in chemical work and airborne operations.

Dutch Agricultural Aircraft

YET another new agricultural aircraft is at present under construction. From the Netherlands it is reported that the HA-001, a product of the Holland-Air company at Katwyk, should soon be complete. The machine is of high-wing configuration, with fabric-covered steel-tube fuselage and wooden wings, and is fitted with two under-wing spray-tanks. The prototype will be powered by a Lycoming engine of 135 h.p., but an increase of power to 150 h.p. for later machines is possible.

Graviner-U.S. Agreement

AN important agreement concerning cross-licensing of patents has been concluded between the Graviner Manufacturing Co., Ltd. (well-known makers of aircraft fire detection and prevention equipment) and the American firm of Fenwal, Inc., of Ashland, Mass. We hope to publish further details next week.

Happy Easter Motoring

TODAY'S (March 29) issue of our associated journal *The Autocar* is a special "Spring Number—Easter Plans" edition, containing a guide to motoring enjoyment—with maximum economy—at Easter. In this enlarged issue there are many pages of valuable advice on holiday motoring, together with all the regular features, for the usual price of 1s.

THROUGH THE ROOF: Martin-Baker Mk 5 ejection seats are to be fitted to production Grumman F9F-8T Cougar Trainers for the U.S. Navy. The installation provides for ejection through the canopy, and ground tests with dummy crew-members (left) were recently made at Chalgrove Airfield. The intermediate tube of the long-stroke gun can be seen projecting through the fractured Perspex. Watching the demonstration were (l. to r.) Mr. James Martin, C.B.E., F.R.Ae.S., managing director of Martin-Baker; Mr. P. Dugan, U.S.N. Bureau of Aeronautics; Mr. Harry Hansen, Grumman; and Mr. Shaide, BuAer. Martin-Baker design features have been used in U.S. Navy seats for the past ten years.

The aircraft illustrated is one of the R.A.F.'s Comet T.2s; later aircraft have nose radar and a cheat-line centred on the passenger windows. The serial number is repeated in large numerals on the white-painted fin.

To Malta for Lunch

—in a Comet of Royal Air Force Transport Command

IT has been said that R.A.F. Transport Command used to be regarded as a "Cinderella" service, and it has had very few aircraft capable of matching contemporary civil airliners, either in performance or comfort. Today, the position is very different. Fundamental reappraisals of our armed forces are leading to a new concept of British strategy in which Transport Command will play a key rôle in the rapid deployment of arms. Its proper equipment is now a matter of the highest priority.

Of the three types of aircraft with which the Command is being re-equipped—Comet, Britannia and Beverley—the Comet represents the greatest change from what has gone before. Last week we were privileged to fly to Malta and back in one of these aircraft in order to form our conclusions on what it can do and how the Command—and 216 Squadron in particular—have settled down with it.

To provide a preface to this account it is appropriate to say something of the unusual background which preceded the R.A.F.'s acquisition of the type. Originally the de Havilland Aircraft Company planned the Comet 2 as a civil transport to succeed the Comet 1, with a slight increase in fuselage length, greater tankage and more powerful and efficient engines—first-generation Rolls-Royce Avons—to confer good performance at the increased gross weight of 120,000 lb. Production was well in hand, and several Comet 2s had flown, when commercial Comet operations were halted just three years ago.

Following the intensive investigation into the Comet 1 it was decided to incorporate into the Comet 2 a considerable amount of redesign, largely of a structural nature, before submitting it for a full C. of A. In particular, the fuselage was largely rebuilt, using heavier-gauge materials in certain sections and substantially reducing the points of peak stress by employing larger radii and substituting oval windows for the original rectangular pattern.

The de Havilland company chose to devote all their commercial energies to the bigger and faster Comet 4; but for financial reasons it was decided to complete 16 Comet 2 aircraft, using the highest possible proportion of parts already manufactured. Ten of these were allocated to R.A.F. Transport Command; three more (with fewer fuselage modifications and a 2,000-hr life) are assigned to special R.A.F. operations; two will be fitted with Comet 4 engines (RA.29s) in the inboard positions for route-flying with B.O.A.C.; and the sixteenth airframe will be used for static tests.

Transport Command already have eight Comets and the remaining two will both be delivered before the end of next month. The first pair to reach the Service—last June—were direct rebuilds of existing civil machines. They were equipped solely for passenger transport and were designated Comet T.2 by the R.A.F. One of them, XK 670, took the R.A.F. delegation to Moscow on the occasion of the 1956 Soviet Aviation Day celebrations. The remaining eight are designated Comet C.2 and are to be employed on all kinds of "work-horse" operations. They are equipped with nose radar and are fitted for the carriage of both passengers and heavy freight.

A diagram below depicts a typical floor plan for a Comet C.2. Flight deck, seat rails, general furnishing and passenger amenities conform closely to the original B.O.A.C. standard; the corollary is that the aircraft sets a new level of Transport Command luxury.

The normal flight crew comprises captain, co-pilot, navigator, engineer and signaller, together with one or more air quartermasters. Passenger seating takes the form of double seat units of the reclining pattern used in the Beverley, installed in the standard rails at 39in pitch facing aft. Leg room is exceptional. Nine rows of seats fill the main cabin and a further three rows can be installed in the forward cabin ahead of a non-structural bulkhead.

When seats are removed from the forward cabin up to 11,200 lb of freight can be carried above the floor, at a maximum intensity of 120 lb/sq ft. The floor plan indicates the manner in which the forward cabin is divided—by lines painted on the interior wall trim—into seven bays, each with a capacity of 1,600 lb. There is also a 185 cu ft baggage hold under the floor aft of the wing. Normal maximum payload is 13,300 lb, and this can be carried over stages of up to 2,300 statute miles with full "airline" allowances.

Before offering our impressions of flying in the aircraft something should be said of the squadron which operates it. All Transport Command Comets are on the strength of 216 Squadron (W/C. B. D. Sellick, D.S.O., D.F.C.), based at Lyneham, Wilts. As related in our issue of November 18, 1955, this unit was formed forty years ago as "A" Sqn., and later 16 Sqn., of the R.N.A.S. Reconstituted as No. 216 strategic bomber squadron, R.A.F., it made 162 sorties over Germany before the 1918 Armistice; throughout the ensuing thirty years it was a bomber or transport squadron in the Middle East and south-east Asia, and finally flew its Valettas back from Fayid late in 1955 after 38 years' continuous service overseas.

As the sole R.A.F. Comet squadron No. 216 has borne no mean responsibility, and crews have not been lightly selected. Most candidates for 216 had at least a "B" (above average) Command

Comet C.2 floor plan: A, captain; B, co-pilot; C, engineer; D, navigator; E, signaller; F, sub-division into seven freight bays. Rails are shown for a twelfth row of seats, forward.

TO MALTA FOR LUNCH . . .

rating and their average experience is well in excess of 3,000 hr. Jet conversion was accomplished by 25 hr on Meteors, followed by a short period on Canberras. Transition to the Comet then required the completion of intensive courses on the airframe and engines, together with the usual pattern of familiarization, circuits, instrument and cross-country flying, operational procedures, emergencies and diversions, rounded off by flights overseas.

This work has already accounted for a high proportion of 216's formidable Comet time of well over 2,300 hr (which, with so fast a transport, implies a great deal of experience). In addition to conversion and crew-training 216 have, since November, operated monthly flights to Aden and Singapore—partly to establish optimum techniques and to give staging posts experience in handling the aircraft—and have flown many operationally productive missions. During the Suez campaign, for example, many Transport and Coastal aircrew were ferried out to Malta (the round trip taking some nine hours), and a considerable number of Comet flights have also been made between Lyneham and Cyprus. Two of 216's machines supported Bomber Command Valiants in Accra last month during the celebration of the independence of Ghana.

For the future, a major task will be the establishment this summer of a regular service to Australia, particularly for the rapid transit of guided-weapon personnel and equipment. At present the provisional route is Lyneham - El Adem - Karachi (night stop) - Negombo - Singapore (night stop) - Darwin - Edinburgh Field (Adelaide). A normal day's flying will be two legs, each of 1,600 to 2,000 miles, taking rather over four hours, separated by a two-hour refuelling stop. Experience has shown that such operations are less tiring to crews than flying the same route with piston-engined machines. Moreover, schedules can be considerably accelerated by slipping crews and by cutting the time spent on the ground at intermediate points. Passengers can, for example, reach Singapore 28 hours after leaving Lyneham.

Our flight last week was made by one of 216's newest aircraft, XK 699, with the following crew: captain, S/L. W. I. Harris, A.F.C.; co-pilot, F/O. J. A. Anderson; navigator, F/L. A. Ludlam; engineer, Sgt. J. A. D. Mutsaars; signaller, F/O. C. Jones; quartermasters, Sgt. W. Fisher and Cpl. P. Fulton. On what might be described as a routine flight to Malta and back, the outward and return stages become largely mirror images of each other. It is proposed, therefore, to devote the remainder or this account to a description of the flight from Malta to Lyneham only.

Luqa airport was shimmering in mid-afternoon sun as we filed aboard shortly before 2 p.m. The starboard Avon 117s were already running and no time was lost in getting the door closed and starting the remaining pair. Then, taxying out, the oval passenger windows overlooked scenes indicative of Luqa's activity: a squat huddle of Venom fighter/bombers . . . weatherbeaten Shackletons emblazoned with Suez black-and-yellow stripes . . . serried ranks of similarly striped Canberras and Valiants . . . and men hustling amid kerosine fumes. Then on to the runway—a modest 1,690 yd.

Forward went the four power levers until XK 699 was straining against the parking brake at 8,150 r.p.m. Then S/L. Harris took the brake off and the passengers' lap-straps were all that stopped them sliding off their rearward-facing seats. A flashing glimpse of the Decca A.C.R.7 scanner rotating above its caravan . . . then our nose lifted hard and we were storming over the solid stone of Luqa town, sleeping in the sun.

Over 2,300 hr of arduous flying have shown the Comet to be the least troublesome aeroplane operated by Transport Command, with the backing of over 30,000 hr of earlier Comet flying. Typical of the sturdiness of the airframe is the bogie undercarriage, designed and manufactured by D. H. and incorporating Dunlop Maxaret braking.

We went forward and watched the altimeter unwind as the island of Gozo slipped below. Our take-off weight had been a mere 104,028 lb—made up of a basic equipped weight, with crew, of 57,858, a zero-fuel weight for the stage of 66,028, and 38,000 lb of usable fuel. This theoretically left 24,142 lb available for payload, but—as the zero-fuel weight shows—we had on board only 41 passengers (6,970 lb) and a ton or two of freight.

Luqa to Lyneham is a little over 1,200 nautical miles, and adverse winds caused us to file a flight plan of some 3½ hr. We climbed steadily at 230 knots to 38,000ft as we followed the direct 324 n.m. track of the first leg to Elmas, on the southern shore of Sardinia. Weather was superb, with tiny patches of youthful cumulus far below. To the left there was Tunisia; to the right there was the south coast of Sicily, lying golden amid green and white breakers in the notoriously blue Mediterranean; and above the cloudless heavens gradually deepened in their hue as we reached the stratosphere.

As we climbed, so did the voice of the Avons—and their thirst—subside. From 38,000ft the Comet was settled into a gentle cruise/climb at constant indicated airspeed—"which," said S/L. Harris, "ought to correspond to Mach 0.73. If it doesn't the trim's wrong." We took stock of the flight deck, roomy enough for plenty of sightseers as well as crew bags and sundry paraphernalia on the floor. At 40,900ft we had passed Elmas and were on the 317 n.m. leg to Istres. The Avons were spinning easily at 7,260 r.p.m., each burning almost exactly 1,500 lb of fuel per hour, with a j.p.t. of 505 deg C. Indicated speed was 215 kt,

(*Concluded on page 410*)

The Comet 2 sets a new standard of comfort for its flight crew just as it does for its passengers. Crews have to complete 75 hr on the type before they are permitted to carry passengers, and training has proceeded intensively during the past six months. Below left, a Comet captain gets down to it wearing a flimsy helmet and battledress—indicative of the 8¼ lb/sq in pressurization and effective air-conditioning. The latter is the responsibility of the engineer, who is seen below right engaged in another of his tasks—the proper management of fuel.

HELICOPTER BLIND FLYING

New Techniques Described in Lecture

ALL-WEATHER operation of helicopters was the subject for discussion at a recent meeting of the Helicopter Association, held in the R.Ae.S. library on March 8. Two papers were presented; the first, covering the general technical aspect, was by Mr. P. A. Hearne, D.C.Ae., helicopter project engineer, B.E.A., and the second, by 1st/Off. J. W. Reid, D.F.C., one of the pilots of the B.E.A. Helicopter Unit, dealt with operational experience to date from the pilot's point of view. Chairman of the meeting was W/C. R. A. C. Brie.

Mr. Hearne (who, incidentally, had also been invited to deliver the same paper to a meeting of the Institute of Navigation) began by saying that the helicopter, with its slow approach speed and high manœuvrability, was well suited to operations in weather minima much lower than the current fixed-wing limits. Present knowledge indicated that it should be possible to maintain schedules with a visibility of 200 yd and a cloud base of 200ft; and with practical experience it was likely that these limits could be reduced to 150 yd visibility and a ceiling of 150ft.

After dealing with a number of general problems which included the provision of autostabilization and rotor-blade de-icing as essential pre-requisites of all-weather operations, the paper was devoted to a consideration of navigation and instrument approach aids, and visual aids to landing at night or in poor visibility. Under the first two headings, the Decca Navigator system received close attention, although both V.O.R. and A.D.F. could be made to work in helicopters in spite of rotor modulation experienced. Over 2,000 hours had been flown with current models of the Decca Navigator and Flight log and its suitability as a primary navigation aid for helicopters had been confirmed. Development of a more advanced version of the equipment specifically for helicopter use in the 1960s was under discussion.

The Decometers had also been used as an approach aid. The technique was to fly down one Decca "lane" with the pointer zeroed, using the intersecting lanes to measure distance from the touchdown point. Approaches were normally made at a forward speed of 20 kt and a rate of descent of 750ft/min. Experience had shown that it was possible to achieve greater accuracy in maintaining track and heading throughout the approach by this method than by other approach systems such as G.C.A.

Development of a new system had also been initiated. This was to be a centimetric-beam I.L.S.-type aid, developed from Elliott Brothers' harbour-course beacon. One advantage of a beam on these frequencies was that, unlike current I.L.S. fixed-wing equipment working in the V.H.F. band, it could be sharply focused to avoid buildings around a city-centre landing site. Another advantage was that it was relatively simple to use the signals in automatic pilot and flight-director systems and, eventually, to develop an automatic landing system. Initial trials with an adaptation of the marine beacon, using aural signals only, had been carried out with success at Gatwick and South Bank.

The most advantageous form of visual aids for the final approach phase, from 150ft altitude and 150 yd distance, had been determined as a result of much experimentation. The pilot had to make the transition from instrument flight to visual conditions in the minimum time and with no risk of confusion as there would be a period of only 15 sec between the break-out point and touchdown. Another important factor to be considered was that for city-centre heliports it was unlikely that space considerations would allow the lighting system to be extended downwind of the site. The pattern developed took the form of a "Cross of Lorraine" with the up-wind bar 90ft shorter than the down-wind one. The semi-flush-fitting lights were of high intensity, emitting between 1,000 and 2,000 candelas in two reciprocal beams with a smaller amount of omni-directional light. The system also included a three-colour glide-path indicator and floodlighting (Fig. 1).

Air traffic control was a problem on which it was not possible to be dogmatic until a higher density of traffic had been reached. However, the indications were that the I.A.T.A. system of parallel track separation might be necessary, in which case development of existing navigation aids would be essential for accuracy.

Conclusions reached in Mr. Hearne's paper were that, although most of the equipment needed to permit all-weather operation of more advanced helicopters in the 1960s was in existence, a good deal of additional development work was still needed in the meantime if the transport helicopter was to be used to the greatest extent of its potential capabilities.

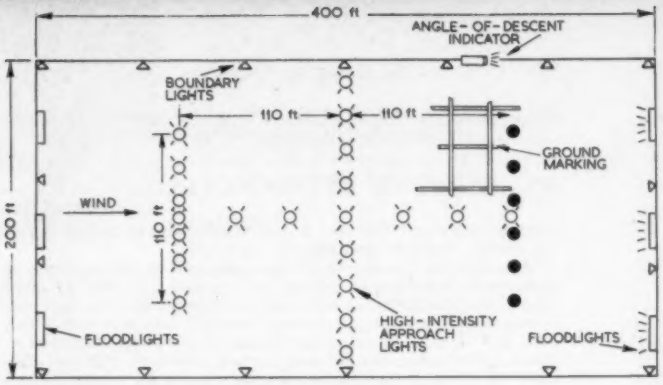


Fig. 1. "Cross of Lorraine" night-landing layout for a standard two-directional helicopter site. The black dots indicate the extinguished bar of lights at the approach end.

Operational Experience. Mr. Reid then gave his paper on the practical aspects of the operations. He said that serious instrument flying of helicopters in Great Britain had been going on continuously for the past five years. B.E.A. were approaching the end of the first phase, in which the helicopter's instrument flying characteristics and the types of radio aid needed had been assessed. A new phase was now beginning, in which the Corporation had started the development of specific techniques and equipment such as autopilots, radio aids for slow descents, special instruments for vertical flight, and flight director systems to be coupled to automatic pilots so that instrument approaches could be made.

As far as the basic handling problems were concerned, the helicopter take-off on instruments was more straightforward than with its fixed-wing counterpart. The procedure was to use a mild form of towering take-off in order to gain height and forward speed together. Yaw could be quickly discerned on the gyro compass and corrected by application of the appropriate rudder control. As the helicopter accelerated away into a climb, the customary stick reversal was experienced, but this could be minimized by aiming for a good climb gradient rather than for the best rate of climb.

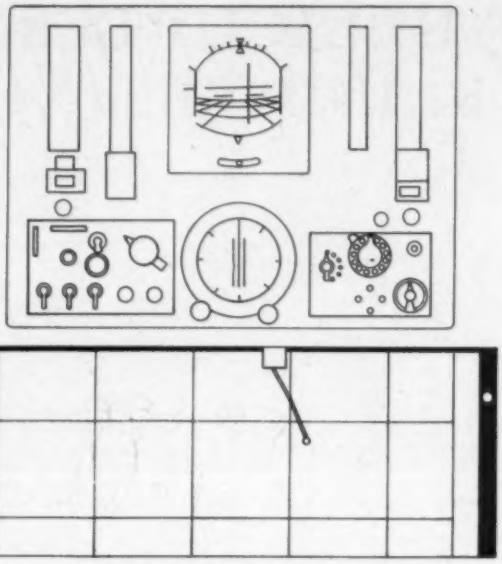
En route cruising at normal power settings was also straightforward but, for procedures, a reduction in power and speed had been found desirable. Descents were best made progressively by a gradual reduction of power, maintaining height by reducing airspeed until the desired glide angle was intercepted. From this stage, a reasonable airspeed was selected, depending on meteorological conditions prevailing. In low-speed approaches drift became most noticeable if the wind was more than 15 degrees off the QDM. With an approach speed of 60 kt on a QDM of 260 deg and a wind of 215 deg at 30 kt, the pilot had to contend with 30 deg of drift. It was particularly disconcerting, on breaking out of a low ceiling, to find that one was looking for the landing site through the wrong window.

The lecturer went on to discuss meteorological problems. Helicopters had to operate in the most difficult meteorological layer of the earth's atmosphere and pilots might find themselves faced with far more let-downs per day than any other pilots had experienced. Local knowledge of weather variations was of great importance, and it would be advantageous to have trained meteorological observers based at the larger city-centre heliports to build up a knowledge of local conditions. One example in the London area was the premature "night flying" condition which could occur in foggy weather near Battersea Power Station with a light southerly air movement. On occasions, cockpit lighting had been necessary at one o'clock in the afternoon. Considerable variation in visibility during the approach to land had also been experienced, reported visibilities changing as much as 800-400-800-200 yd during the last two miles of the trip to South Bank.

Air traffic control presented a number of problems, but once the controller was familiar with the helicopter's characteristics little delay occurred. Experience with G.C.A. on instruments had not, however, been particularly reassuring, as the large heading changes needed to prevent deviation from the QDM in a cross-wind were disconcerting. Also, the helicopter's slow acceleration and deceleration without large attitude changes made it difficult to regain the glide-path quickly after displacement. With pilot-interpreted aids, such as the microwave I.L.S., results had been better. A Decca approach system using large-scale charts on the Flight Log and showing displacement in azimuth and height against range was under development.

There was little doubt that the development of special instruments for helicopters was lagging far behind the development of the helicopter itself. There was still no satisfactory slow-reading airspeed indicator; artificial horizons in general use could not correctly interpret divergence in the pitching plane (when climbing they showed descent and when descending they showed climb) and they lacked a readily adjustable horizon bar; an efficient radio

Fig. 2. Schematic diagram of Mr. Reid's suggested instrument layout, with Decca Flight Log, described in detail below.



HELICOPTER BLIND FLYING . . .

altimeter that could be used in conjunction with stabilized hovering devices was also desirable.

The time had come for a new approach to the problem of instrument presentation for helicopters and his own proposal (Fig. 2) included two dial instruments and four ribbon instruments in place of the ten dials on existing panels. The upper dial, which gave the pilot his most important forward-looking information, was a combination of pitch-roll attitude and flight-director indicator. It also incorporated the turn-and-bank needle turned forward 90 deg so that only its down-turned tip was seen. The lower dial was the gyro-magnetic compass. To the right of the dials were the altimeter and vertical-speed indicator, while to the left were the airspeed and rotor-speed indicators. A red Perspex screen on the altimeter, activated by the radio altimeter, indicated terrain clearance. Elevation in relation to an I.L.S. glide-path was shown on a small indicator at the left of the artificial horizon, while the Decca Flight Log was immediately below the gyro compass. Because of the very precise flying required in restricted areas, a modified flight-director system coupled to the automatic pilot was most desirable, and work was scheduled to begin on this project as soon as equipment was available.

Mr. Reid concluded his lecture with a mention of night-flying problems—which, fortunately, were few. After much experimentation, the "Cross of Lorraine" lighting pattern had been accepted as providing the maximum attitude information on the approach and whilst hovering prior to touchdown. For smooth landings a good deal of ground illumination was helpful, as also was the readily adjustable landing light which, on one helicopter type, was controlled from the top of the cyclic-pitch stick.

THE DISCUSSION

W/C. R. A. C. Brie, the chairman, opened the discussion by thanking the lecturers for two excellent papers. Their most significant aspect was that these results were all based on factual experience. No fanciful theorizing was involved and only existing equipment had been referred to. The objective was known and all that was required to attain it was further development of known techniques. It was interesting to recall that, nearly ten years before, B.E.A. had operated such a successful scheduled night mail service in the Norwich-Peterborough area, an achievement that had been a "first" in helicopter activities.

Mr. K. Reed (Saunders-Roe) thought that helicopter manufacturers and operators were faced with a tremendous task in the near future. Within three years larger machines would be available, and unless immediate steps were taken to enable preparatory development to be pursued energetically at the present time, ancillary equipment would not be ready soon enough to allow the larger machines to be used to their greatest potential. Action at a very high level was called for. He would like to see more aerodynamic stability introduced into helicopter design and he wondered if better instrument flying results could not be achieved by using rotor-plane sensing through the flapping hinges, instead of fuselage-attitude sensing, as the basis on which instrument indications were presented. Among the important problems requiring much attention were de-icing of rotor blades, position error of airspeed indicators and instrumentation development. He was attracted by Mr. Reid's proposals for a new instrument-panel layout but he would like to go even further and incorporate all the necessary instrument pointers on one large dial immediately in front of the pilot.

Mr. D. A. Wilkinson (A. and A.E.E., Boscombe Down) said that his Establishment had carried out a good deal of night and instrument flying experimentation from the military point of view. Their experience confirmed many of the results described, although some aspects were different when seen from the Service angle. Their lighting pattern had to be capable of improvisation with torches or flares, but a similar design had been evolved. He stressed the value of parachute flares for emergency night landings in single-engined helicopters. Boscombe Down was interested in low-airspeed measurement and had under development for this purpose an instrument which was showing great promise.

Mr. R. Swales (Decca Navigator) said that the accuracy problems referred to by the lecturers were caused by static and had been resolved as far as installations in fixed-wing aircraft were concerned. The solutions would soon be applied to helicopters. In reference to Mr. Reid's proposed new panel layout, he asked whether B.E.A. were satisfied with the size and shape of the Flight Log presentation.

Cdr. N. Fuller (Royal Navy) wanted less stress placed on the need for artificial stabilization and more on the desirability of improved aerodynamic stability. It had been achieved to a certain extent on some machines (e.g., the Westland Widgeon, Fairey Ultra-light and Bell 47 J), so why was it not possible with others? He thought that the combined flight director/attitude indicator was too complicated and would like to see an instrument with just two-cross pointers which gave the pilot all the information he required.

F/L. A. Sharples (Lee-on-Solent) asked for more co-operation between civil and military helicopter users. He thought the weather limits could be lower for Service flying. A typical Service pupil on a course was able to cope with break-outs at 200ft after an instrument let-down through cloud.

Mr. J. S. Shapiro (consultant) was of the opinion that while improved aerodynamic stability was desirable for small helicopters it was a waste of time trying to achieve it for large transport machines. They would still be affected by instability of the atmosphere itself, and artificial stabilization was the better approach.

Major R. I. Walton (R.T.P.S., Farnborough) gave a brief description of the rotor blade de-icing trials with a Bristol Sycamore in Canada. To test the de-icing equipment the helicopter had been hovered in an artificial cloud. The trials had shown great promise.

Mr. M. C. Curties (R.A.E., Farnborough) questioned whether Mr. Reid's proposed new instrument panel would in fact save space in the long run. The ribbon-type instruments he specified depended on transmission through servo links, which introduced an element of unreliability into the system.

Mr. J. W. Leach (A. and A.E.E., Boscombe Down) was disappointed that more had not been said about engineering features in basic design. There were still many problems to be solved before helicopters would be suitable for all-weather transport operation. Not the least of these was noise, and crew comfort in relation to noise and vibration fatigue. The development of suitable restrainers to prevent blade sailing when starting and stopping rotors in high winds was also essential.

Mr. Twinney (R.A.E., Farnborough) said it appeared that, by the time large transport helicopters were available, TACAN would probably have reached a stage where it could be used as a favourable alternative for the Decca system. He asked whether any consideration had been given to its possible utilization.

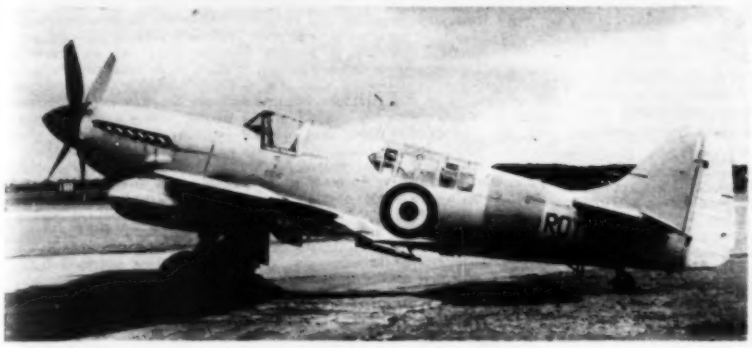
Mr. Hearne, replying to the discussion, said he fully agreed with the desirability for improving aerodynamic stability quite apart from artificial stabilization requirements. He thought Gustafson's work in this respect was of great importance. Rotor-plane sensing as an alternative to fuselage-attitude sensing for attitude indicators had been tried in the U.S.A. and it had been found that there was no appreciable difference in the ability of a pilot to control the helicopter using either method. Position-error was a serious problem with airspeed indication and a ground speed indicator might well be desirable.

The most recent information he had from the U.S.A. regarding pilots' opinions of the combined flight director/attitude indicator was that although conflicting opinions did still exist, the school of thought that had originally opposed its introduction was now becoming inclined to revise its views.

B.E.A. did their best to ensure that Service operators were informed as to their activities through the medium of the Ministry of Supply. (A number of other speakers from various Service units confirmed that liaison arrangements were entirely satisfactory.)

Consideration was being given to the use of TACAN as a secondary navigation aid but it was not expected that a station would be available for use on this side of the Atlantic for some time. He had been surprised by the fact that some manufacturers appeared quite unaware of the necessity to make provision for many of the navigational facilities, and closer liaison between manufacturers and operator was needed to avoid mistakes that had been made in the past.

Mr. Reid, also in reply to the discussion, did not agree with the questioner who thought his proposed new panel layout was more complicated. Its purpose was to provide more space for better vision forward when breaking out of cloud. He realized there were problems associated with ribbon-type instrument presentation, but there was a good deal of development work in progress in the U.S.A. to meet certain fixed wing requirements, and he hoped the results might be useful for the helicopter application. The size of the Decca Flight Log had been the subject of much discussion and they felt that probably it could be more square in shape and slightly smaller to advantage. With existing instruments, the airspeed indicator was unreliable below 40 kt and a more constant glide-path could be maintained by concentrating on the attitude indications during an approach at slow forward speed.



A study in Naval markings: a Beech C-45 of the U.S. Navy, based at Blackbushe (top), and a Fairey Firefly T.T.4 target tug with its new—larger—Royal Navy inscription.

AIRCRAFT INTELLIGENCE

Poland

Aircraft Production. Part of the Communications Equipment Factory at Mielce has been turned over to the production of sports and training aircraft and of metal gliders. The Kania glider tug is now nearing completion, and the M-2 two-seat trainer is under construction. The M-2 will be in the class of the Zlin 26 and Junak II and will be of all-metal construction. Quantity production could begin in 1958. It is thought that the Mielce factory could without difficulty produce a hundred all-metal gliders annually, suitable not only for home use but for export to such customers as India and China. A prototype should be completed in about six months.

Norway

North American F-86F Sabre. Norway is now getting its first F-86F Sabres and by the summer two squadrons will have been equipped with this type in replacement of Republic Thunderjets.

Italy

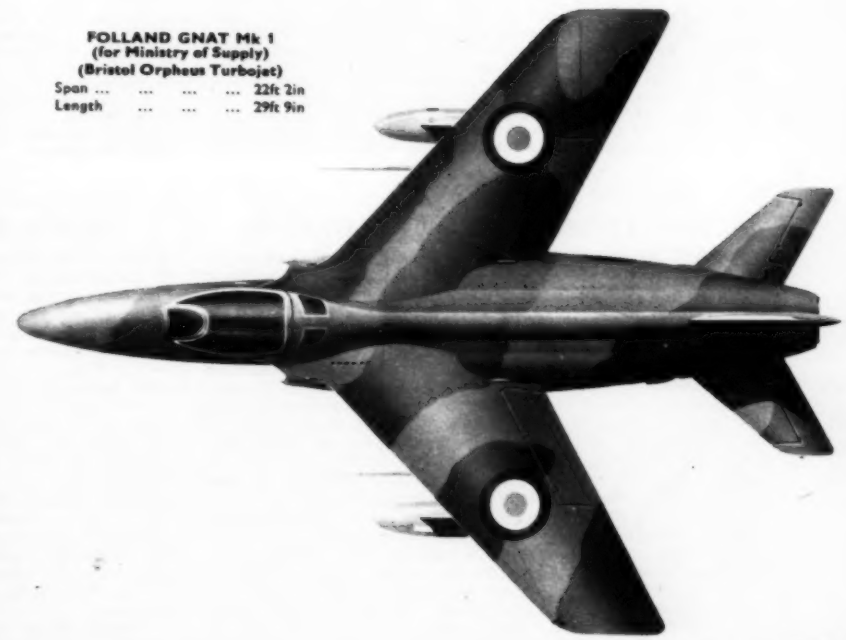
New Designs. The Italian Air Ministry is interested in a twin-engined communications and light transport aircraft being designed by SIAI Marchetti. The first version will have turboprops (apparently Rolls-Royce Darts) and a later model with turbojets is foreseen. The Macchi concern will fly the first prototype of its MB.326 trainer (Armstrong Siddeley Viper) towards the end of the year. Agusta are completing the twin-engined AZ.8L and a 14-seat helicopter in which the Italian Air Ministry is interested. The Nardi FN.333 amphibian is not flying at present. The first pilot to fly the type was killed when the aircraft spun involuntarily during a stall check with flaps down. It was rebuilt and Ing. Ferrari took it into the air, but he has now ceased his work on the type. The machine has now completed its initial tests and certification tests are under way. Piaggio are designing the P.155 amphibian, with a 4,000 h.p. turboprop. Military and civil versions are in prospect. Aviamilano are hard at work on a batch of 30 Falcos and on the prototype four-seater Nibbio F.14, and Pasotti are completing tests on the Airone F.6 with Walter engines and are studying a version powered with Lycoming engines.

Switzerland

Aircraft Developments. Following the rejection by the Swiss Parliament of the proposal to order 40 Marcel Dassault Mystere IVAs (already recorded in *Flight*), a Hawker Hunter F.6 and a Canadair Sabre 6 have been extensively evaluated by Swiss test pilots. Examples of these aircraft have frequently been seen over Zurich recently. Additionally, a Hunter two-seater has been demonstrated, and the Swiss military minister, Mr. Chaudet, was thereby enabled (reports a Swiss correspondent) to become "the first supersonic member of the Bundesrat." In Basle, a Bell 47J has been delivered to the Schweizerische Rettungsflugwacht (Alpine rescue organization). This is the first helicopter of its type in Europe and 500,000 Swiss francs necessary for its purchase, maintenance, etc., were enthusiastically subscribed by the Swiss people.

FOLLAND GNAT Mk 1
(for Ministry of Supply)
(Bristol Orpheus Turbojet)

Span	...	...	...	22ft 2in
Length	...	...	...	29ft 9in



DISCIPLINE AND LOYALTY

The Air Training Corps and the Community: a Lecture by W/C. Norman Macmillan

WHEN he gave a paper before the Royal Society of Arts on March 13 under the title *The Air Training Corps: Its History and Place in Contemporary Society*, W/C. Norman Macmillan said [as briefly reported in *Flight* last week] that in his experience the great virtue of the A.T.C. sprang from "its capacity to train young men educationally, physically, in discipline and loyalty." One outward and visible sign of such training was the A.T.C.'s smartness on parade, and when the chance occurred of showing what they can do on a big occasion the cadets made the most of it:—

"A.T.C. Wings have few opportunities of composite parades. For the annual Wing Inspection, squadrons meet at the place of inspection, and may not again meet until the next year. They are sorted out on the parade ground into a pattern suitable for a Wing parade. Three composite squadrons may have to be created from some seventeen Units which are usually geographically separate. No rehearsal is possible.

"Royal Air Force officers have expressed astonishment that these parades are performed efficiently, for practice parades would be held for three weeks before a similar inspection of the regulars of an R.A.F. station.

"One secret of the success of the Air Training Corps is the immense pride the cadets take in their performance. . . . The Wing Headquarters is responsible for the parade orders. These are drawn up in complete detail well in advance and distributed to every Unit. Each Unit knows beforehand which composite squadron it will belong to, and where that squadron will be stationed on the parade ground. Instructions accompanying the sketch plan include every verbal command which will be given. On the day of inspection everything falls tidily into place."

Flying also played an important part in A.T.C. training:—

"Formerly Dominie and Oxford, and now Anson, aircraft have been used to give cadets air experience. These aircraft visit scheduled R.A.F. stations at intervals, and A.T.C. Wing Headquarters allots flying time to squadrons. But a special programme is often arranged for the annual inspection, with the object of giving every first class and proficient cadet a flight, and perhaps probationer cadets their initial air experience. Sometimes operational aircraft add to the air lift, and then every cadet present, and possibly all their officers may be airborne. . . .

"Flying is the jam that sweetens the pill of the hard work demanded of cadets in squadron class-rooms, where mathematics, electricity, theoretical navigation, stellar charts, aircraft recognition, engines, tools, airframes, theory of flight, and other serious study subjects pack the syllabus of training and give the A.T.C. its high value as a post-school or extra-to-school educational organization. But flying has greater value than sugar coating. Flying demands discipline. That discipline is not always easily discernible, because aircrews have a wonderful ability to disguise it with a seeming casualness that is mere veneer. Cadets sense that discipline as a controlled concentration, without which no pilot can properly handle an aeroplane, and no aircrew can perform its duty as a team. Through this contact cadets realize that discipline, self-discipline, must enter into every aspect of life if they are to make a success of what they strive to do."

W/C. Macmillan then went on to put this kind of training within the perspective of aviation today and in the future:—

"At a time when aviation has assumed first place in defence, girdled the world for transport, mails, and commerce, and opened up new areas of undeveloped land, it is important that our youth should grow up with knowledge of the air. For their contact with and knowledge of the air will assist the United Kingdom to continue to be one of the great air nations, as in the past she became and remained a great maritime nation through the ready contact of her people with the never distant sea. No organization other than the Air Training Corps has ever given Britain's youth such contact with aviation. . . .

"It is important to the Royal Air Force, and to the Merchant Air Force, that a considerable body of air-minded and air-educated youth should form a good cross-section of the younger generation each year. For whatever the tendency towards greater development of military robots and ballistic missiles, there must be a period during which manned aircraft will continue to be required. It is not certain that surface-to-air guided missiles can altogether displace manned fighter aircraft. Manned maritime aircraft cannot be replaced by robots while a submarine threat exists, neither can manned military transport aircraft while human passengers, and light and valuable freight, have to be carried by air.

"Looking ahead, one can see the nuclear-powered aircraft of the future, with an immense duration and electronic jamming, and equipped with air-to-air and air-to-surface guided and self-homing weapons, perhaps replacing and certainly implementing naval surface and underwater missile ships, and it will be a manned aircraft. Neither is there any near prospect of robot civil transport aircraft, except possibly for express mails. So the demand for aircrews for both military and civil aviation will continue for a long time to come, certainly for as long as the air aspirating engine (with supercharger or compressor) continues to be used, or the atmosphere is the reacting medium for providing lift. And the increasing technicalities of crew training will demand that initial instruction at an early age should prepare the way for subsequent advanced study."

At the end of his lecture, W/C. Macmillan summed up the work of the A.T.C. against the background of the R.A.F. and the contemporary society in which it exists:—

"Recently, the Corps has been the best source of recruiting the regular entrants whom the Royal Air Force most desires. Naturally, the R.A.F. regards that as the most important aspect of the Air Training Corps. Yet I know of men, including headmasters, associated with it, who would not lend their aid so readily if they thought its sole object were military. They view its dual function of training for good citizenship as at least equally important. This is, perhaps, a question of viewpoint. A good airman is always a good citizen, too. And in my experience of the Corps I have never once heard of a cadet returning from adult service in the Forces who has not been grateful for the training given him in the A.T.C. By its adherence to discipline, physical training, its opportunities for further education, association with the life of the R.A.F., its many opportunities for flying, and its outstanding gifts of foreign travel, it is making a contribution through youth to contemporary society whose full worth should become continually more apparent in the years ahead."

NEW VICKERS EDUCATIONAL PLAN

A NEW scheme to encourage the training of technologists for industry was announced by Viscount Knollys, chairman of Vickers, Ltd., in London last week. The main provisions of the scheme include the construction of a hall of residence at Imperial College, London, and the establishment of three new engineering scholarships at Cambridge University.

The new hall of residence—"an original and practical contribution towards providing for the needs of technical students where the need is greatest"—will be financed by the Vickers group at an estimated cost of £150,000. It will accommodate about 70 students, will be located in Princes Gardens near the main buildings of Imperial College, and should be completed in 1959. Its name will be Weeks Hall, in recognition of the work of Lord Weeks, who, when chairman of the group, had set up a committee to consider the problems of the shortage of technologists and to formulate a unified group educational scheme.

The three new engineering scholarships are in addition to the existing scholarships offered by the Vickers group. They will each be worth £400 per annum and, initially, will be introduced at yearly intervals (1957, Christ's College; 1958, Downing College; and 1959, Trinity Hall). Other aspects of the group's new plan include further scholarship and sandwich-course awards to apprentices; and new apprentice training schools.

Announcing these details, Lord Knollys said that there were approximately 5,200 apprentices in the various Vickers companies, some 1,300 of whom were engaged in the aircraft side of the group's activities. He disclosed also that the new hall at Imperial College would be used by the group during vacations as a staff college for management courses.

IN THE HOLLYWOOD TRADITION

JOHN FORD is a film director with an overwhelming claim to distinction in that he made, before the last war, a "western" called *Stagecoach*—a classic, and the criterion by which all westerns should be judged. A new film of his opened recently at the Empire Theatre, London, and it is due to be generally released on May 27. This M-G-M Metrocolor picture —*The Wings of Eagle*—is a rather sad decline from Mr. Ford's high standard. The story is based on the life and writings of Cdr. Frank W. ("Spig") Wead, U.S.N., and, unfortunately, its treatment is only too familiar. We first see Mr. John Wayne, as Wead, impersonating a wild young aviator disobeying orders concerning solo flying in order to focus attention on his Service's shortage of aircraft; we are confronted with Miss Maureen O'Hara as his neglected wife; she eventually leaves him; they are reconciled; illness comes, then dogged recovery; and so on. The familiarity of these cinematic clichés is to some extent redeemed, not by the fact that the story is basically true, but by one good sequence in which the hero takes up a single-float seaplane (*circa* 1919) against orders, some wildly hilarious moments ensuing.

The real Wead led the U.S.N. team which won the Schneider Trophy race in 1923. Apart from the fact that the famous Trophy is depicted as a cup, there are newsreel extracts supposedly of the 1923 race, but showing monoplanes instead of the biplanes which formed the whole entry. The usual sentimental situations impose a strain on a cast of competent players, but near the end of the film there is compensation in some genuine late-war colour newsreel shots, vivid with scarlet tracer bullets and orange flower-bursts from aircraft carrier defensive fire.

GRAHAM LAND VICISSITUDES

MUCH of the discomfort, risk, hard work and sheer rigorousness—with occasional rewarding glimpses of icy loveliness—which typifies Antarctic life is captured in these pictures from the Graham Land aerial survey expedition, which has just completed a highly successful season (referred to in a news item last week and in a leading article this week).

Below, a blizzard sweeps over the expedition's two Cansos, hauled up on the beach for safety; and at the top (left) ground crews do some excavation afterwards. Above, right, one of the aircraft taxies out into Whalers Bay for take-off on a photographic sortie which may last nine hours, and (on the left) two members of the expedition go foot-slogging on another part of its work—ground control. At the top, right, Brabant Island in its snowy beauty—though hardly encouraging for forced landings—is seen from one of the Cansos. Only rarely, during the short Antarctic summer, does Graham Land allow itself to be so photogenic.

SOLID-PROPELLANT ROCKETS — A B.I.S. LECTURE

AT the meeting of the British Interplanetary Society in London on March 2 a lecture was given by Mr. E. T. B. Smith, of the Ministry of Supply, on *Solid-propellant Rocket Motors*. The lecturer introduced his subject by pointing out that although liquid propellants might have, in some cases, rather higher specific impulses than the solid type, there were many factors—such as ease of handling, good storage life, freedom from toxic and fire risks, and instant readiness without the need for maintenance—which made solid propellants most attractive for many applications.

The lecturer went on to describe the propellants used, the two main types being the double-base variety (gelatinized mixtures of nitrocellulose and nitroglycerine) and composite propellants made from inorganic solid oxidizer dispersed, with perhaps an organic fuel, in a binder. The double-base propellants could be shaped by extrusion (cordite) or by a casting process (cast double-base); and, depending on the choice of binder, the composite propellants could be cast or pressed into the motor body tube, becoming bonded to the inner wall. In all cases the propellant burned in a rocket entirely without any external oxidant, and the burning surface was found always to recede in a direction normal to the local tangent to the surface. The rate at which the surface receded (the burning rate) was dependent upon the pressure of the gas above the surface and upon the bulk temperature of the propellant.

The speaker demonstrated how burning-rate data could be used to match a propellant charge of given burning area to a nozzle of given throat size, and how the variations of burning pressure encountered in firings at different temperatures depended on the pressure and temperature sensitivities of the propellant.

A phenomenon mentioned by the lecturer was that of erosion: this consisted of an enhancement of the burning rate due to the passage of gas, from another part of the burning surface, over a particular region. It was said to account for the initial peak pressures observed in some rockets, where the gas velocities in the propellent charges were momentarily high just after ignition.

Mr. Smith went on to discuss the ways in which charges were designed to give particular burning times and thrusts. He pointed out that, in the majority of cases, it was desired to produce a thrust-time curve which was substantially level during the burning time, and showed that this required that the area of the burning surface should not change appreciably from ignition to the end of burning. Such conditions could be achieved, for charges burning all over their surfaces, with a simple tubular configuration; but if it were desired to inhibit the charge from burning close to the wall of the rocket body, then special shapes must be used for the burning surface: typically, these took the form of conduits along the length of the propellant, of "star" cross section or a number of narrow arcs, bearing webs of propellant to hold the charge together. In order to extend the range of thrusts and times which could be used, the charge might also take the form of a cigarette, burning on one end-face only, or the conduits might be so shaped that a reduction in surface area at one end of a charge compensated for an increase at the other as the propellant burned away.

Instability during burning was a problem, held to be due to resonance being set up in the gas when the conduit shape passed through particular geometrical forms, and so increasing the burning rate, causing severe peak pressures. Suggestions for cure were made by Mr. Smith, who closed his lecture by describing the construction of the case components of a solid-propellant rocket motor: typically, a steel case was used together with a steel nozzle, to act as a heat sink, fitted with a carbon or refractory throat section.

TO MALTA FOR LUNCH (continued from page 404)

the Machmeter registered 0.735 and the outside-air temperature was −55 deg C, giving a true airspeed of about 500 m.p.h. S/L. Harris cut in the Smiths S.E.P.2 autopilot and left the Comet to the 50ft tolerance of the height-lock. (For the Comet, say 216 Sqn., a speed-lock would be more valuable.)

F/O. Jones kept in close touch with Lyneham, for, like most jets, Comets divert at cruising height should there be any doubts about their destination. Sgt. Mutsaars looked up from his Normal-air panel to point out that at sea level the fuel supply would dwindle by 1,000 lb on a single circuit. Musing on this fact we left Istres and, the entire Alps forming a backcloth to the starboard wing, pressed on into France.

It was now a straight run of 556 n.m. to Wiltshire, and the Comet was as steady as a rock. Up front the interior noise was mechanical, reminiscent of a power station, and a thick crust of frost slowly built up on the windscreen frames. Aft the noise was all jet, and one found more frost wherever there was a metal path by which heat could be lost to the skin. But neither factor prevented the Comet from being synonymous with comfort.

Unbelievably, Lyneham reported almost a complete "clamp," with heavy rain and a low ceiling. S/L. Harris elected to arrive overhead at 20,000ft and then make a smart G.C.A. let-down. This he proceeded to do, and the Comet swept down at flight-idling power, clawing with her air brakes at a sky full of grey vapour. Dismal green fields appeared below as we began a long run in, while air brakes gave way to partial flaps and the Avons opened up to high thrust to hold 230 knots. On final approach the broad flaps reached their fantastic maximum depression of 80 deg, and our eight main wheels found the Lyneham runway—hard.

XK 699 had worked like a sewing machine. The only trouble we personally experienced was that the toilet water system became exhausted and we were unable to wash off the perspiration of Malta. Number 216 seem to be on to a good thing. W.T.G.

CAMBRIDGE R.Ae.S. BRANCH

AT the inaugural meeting of the Cambridge branch of the Royal Aeronautical Society (the 28th to be formed), held in the Cambridge University engineering laboratories on March 11, Mr. Handel Davies, chairman of the branches committee of the R.Ae.S., referred to claims made recently in certain sections of the popular Press that aircraft as we knew them were "on their way out." It was his opinion that this was not so; the next 25 years would see far greater developments in flying than had been seen in the past 25, and this country would be in the forefront of these developments.

Mr. C. F. C. Sneesby, chief designer to Marshalls Flying Services, Ltd., said that the advantages of aviation "were not those that could be counted tomorrow." They would be enjoyed by future generations. "The amount of encouragement given in this country to flying as a hobby is small indeed," he continued. "People fly because they enjoy it, and the fact that they are enjoying it is as it should be."

The president of the new branch is Prof. W. A. Mair, Professor of Aeronautics at Cambridge University; the chairman, Mr. C. F. C. Sneesby; secretary, Mr. R. C. Godwin; and treasurer, Mr. R. W. Reeve.

Also attending the meeting—which was so crowded it was a case of "standing room only" for many potential members—were Dr. A. M. Ballantyne (secretary of the R.Ae.S.) and Dr. N. A. de Bruyne, managing director of Aero Research, Ltd.

FORTHCOMING EVENTS

Mar. 30. Air-Britain: Annual General Meeting.
Apr. 1-6. Southampton University: Course on Aircraft Acoustics.
Apr. 4. R.Ae.S.: Main Lecture: "Engine-Airframe Integration," by L. F. Nicholson, F.R.Ae.S.
Apr. 5. Helicopter Association: "Problems Associated with the Strength Assessment of Rotor Blades," by V. A. B. Rogers, D.C.Ae., A.F.R.Ae.S.
Apr. 5. A.B.A.C.: Annual Dinner.
Apr. 6. British Interplanetary Society: "History of Rocket Development in the Walterwerke," by H. Walder.
Apr. 9. Aviation Forum: Annual General Meeting.
Apr. 9. R.Ae.S.: Section Lecture: "Fail-Safe Structural Design," by N. F. Harpur, Grad.R.Ae.S.
Apr. 13-14. Plymouth Aero Club: Mayflower Air Rally, Roborough.
Apr. 16. R.Ae.S.: Section Lecture: "Simulation Techniques in Aeronautics," by J. J. Foody, Grad.R.Ae.S., and R. A. Paul.

R.Ae.S. Branch Fixtures (to April 16)

Mar. 29, *Birmingham*, "Artificial Satellites," by M. W. Ovenden. Apr. 1, *Derby*, "Reminiscences of a Flying Career," by G. A. V. Tyson. Apr. 2, *Belfast*, Aircraft Production," by G. T. Gedge; *Boscombe Down*, "High Speed Experimental Test Flying," by Lt. Col. C. E. Yeager. Apr. 3, *Weybridge*, "Atomic Energy for Aircraft Propulsion," by J. E. B. Perkins; *Chester* "Development of the Deltic Engine," by C. D. Carmichael. Apr. 4, *Cheltenham*, "Arctic and Tropical Aircraft Trials," by R. K. Cushing; *Yeovil*, Annual General Meeting and Film Show. Apr. 10, *Christchurch*, Annual General Meeting and Film Show; *Glasgow*, Annual General Meeting; *Luton*, "Measurement of Aircraft Vibration in Flight," by D. A. Drew. Apr. 11, *Gloucester and Cheltenham*, "Application of Nickel Alloys to Aircraft," by W. F. Featherstone; *Isle of Wight*, Branch Prize Lectures. Apr. 16, *Belfast*, Annual General Meeting.

"Flight" photograph

"NIGHT PHOTO JET"

Douglas RB-66Bs with the 19th Tac Recon Sqn. at Sculthorpe

ONE of the most vital tasks of the NATO air forces is to provide the ground forces with up-to-date reconnaissance information of all kinds. At least two wings of the 12th United States Air Force in Europe are equipped specifically for this task and the most modern specialized aircraft are being issued to them. The 10th Wing at Spangdahlem, near Trier, has RB-57s for night photography (described in *Flight* for January 11), RF-84Fs for day photography and B-26s and RB-66Cs for special (radio) reconnaissance. The 66th Wing at Sembach has a similar organization, and one of its squadrons, the 19th Tac Recon Sqn., based at Sculthorpe, Norfolk, is in process of re-equipping with Douglas RB-66Bs. The squadron retains for the time being some of the North American RB-45C Tornadoes it has been flying from Sculthorpe for the past few years.

This East Anglian base was a hive of activity when *Flight* visited it last week. Besides the 19th Squadron's B-66s there were the boom-equipped KB-29s and three-point probe-and-drogue KB-50s of the 420th Air Refueling Sqn.; the B-45s of the 47th Bombardment Wing (*Flight* for March 25 and April 22, 1955); the F-84Fs of the 81st Fighter Bomber Wing, advertising themselves prominently as "world bombing champs"; and a number of other aircraft including C-119s, C-47s, a couple of aged B-26 target tugs and T-33s. During the afternoon a U.S. Army H-21 helicopter with an external fuel tank arrived and flew sedately along behind the "follow me" van, through the maintenance area and to its parking spot.

The 19th Tac Recon Sqn. (Night Photo Jet), which is commanded by Maj. J. B. Anderson, began exchanging its RB-45Cs for RB-66Bs on February 3 this year. So far almost a dozen of the sleek new machines have arrived and are being intensively flown in order to complete the crew familiarization programme. Aircrews first undergo a three-week course with a special training unit and follow this with 15 hr in a B-66 simulator in Germany. The crew then has demonstration flights in the aircraft and reaches the operational training stage after a minimum of fourteen local flights.

The RB-66B pilot sits right over on the left within the sharply swept windscreen structure and navigator and gunner sit side-by-side behind him. All three have automatic ejection seats, an alternative escape method being to push their way downwards through the main access hatch in the belly aft of the nosewheel.

The RB-66B is quite a change from the stately old RB-45. The new machine has swept wings, a single pilot's position, a narrow-track undercarriage and a very large ribbon-type drag-chute which is deployed at each landing. Though not a "hot" aircraft, the RB-66 must be flown with due care, for g-loading and other limits can be exceeded relatively easily. The machine was in fact designed purely for day or night photography at high or low altitude. Its structure is extremely strong and, while its altitude capabilities are distinctly inferior to those of aircraft like the Canberra it can comfortably work "flat out on the deck." We gathered, in fact, that the main mission of the 19th Sqn. was low-level night photography, though the approach to the target area would often be made at high level.

In the photographic compartment, located in the fuselage section beneath the wing, the RB-66B carries a fan of three cameras (two oblique and one vertical) supplemented by a very large single vertical camera immediately behind them. Metal panels cover the apertures in the fuselage belly. Immediately aft of this camera installation is a specially designed photoflash compartment in which use is made (for the first time, claim Douglas) of a chain-rack stowage system. Stacks of eight photoflashes (they can be of various types) are attached to six of these chain systems, each of which is driven by a hydraulic motor and has its own small launching hatch. The chain drive lowers the photoflashes and drops them through the hatch at the required time intervals. The rate of dropping can be suited to the RB-66's maximum speed to provide a continuous illuminated path immediately behind the aircraft.

There is a hatchway through which, after de-pressurizing the cabin, a crew-member can climb into the camera compartment. Though this is regarded mainly as an emergency facility, it can be used to reload the cameras during a long mission.

The most interesting and significant aspect of RB-66B operation is, of course, the technique used to locate a pin-point target at low level by night. But, not surprisingly, the Americans would say very little about this except that they were themselves still developing a suitable operational procedure. Map-reading and similar methods are virtually impossible except under rarely encountered ideal conditions. We noted from an inspection of the aircraft that it carries, in the nose, an AN/APS-27 radar, and this presumably has advanced mapping capabilities. We further noticed a very large di-electric panel under the fuselage aft of the mainwheel bays. At what lies behind this we can only guess; but, putting two and two together to make five, and noting Douglas statements about the RB-66's comprehensive navigation system, we would hazard a guess at some self-contained navigation system, probably supported by Doppler radar.

A very broad di-electric band across fin and rudder also indicates that the whole skin area above this band is used as a long-range communications aerial. From external markings, too, we could identify a glide-slope aerial, denoting use of I.L.S., and a colander-type static pressure-sensing intake marked as serving the autopilot.

The sole armament of the RB-66B is its defensive General Electric automatic twin 20 mm tail barbette, operated by the gunner in the crew compartment. We were rather surprised to learn that the RB-66B has no weapons bay as such and carries no offensive stores externally. Pylon tanks have been fitted outboard of the engine nacelles for ferry flights, but they have largely been discarded because, like the Canberra, the RB-66 does not fly any farther with such tanks than it does without them. Weight, drag and control-deterioration caused by the tanks almost overcomes any advantage gained from the extra fuel carried.

We asked the American pilots what the RB-66 was like to fly. Though they were still new to it and still very much in the familiarization phase they seemed to like it. They said that the only fighter which seemed able to stay with them was the Hunter. We gathered that because of equipment limitations the RB-66B is not aerobatic, but its manœuvrability, both at high speed low down and on the approach are considered to be exceptionally good. Reports from other sources give the RB-66 a limiting Mach number something over 0.9; and Douglas themselves put its top speed between 600 and 700 m.p.h. The RB-66B weighs

(*Continued on page 414, after double page of RB-66B photographs.*)

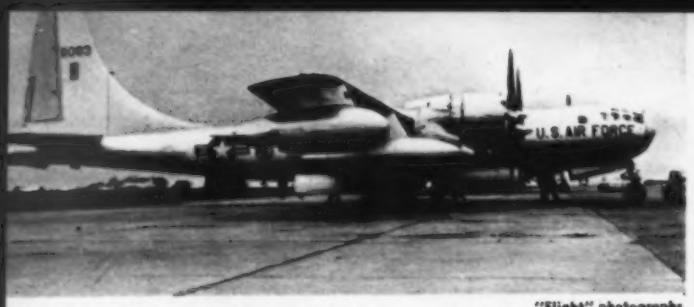
"NIGHT PHOTO JET"...

Gleaming in early spring sunshine (above), an RB-66B from Sculthorpe manoeuvres over East Anglia for "Flight's" camera. Sole armament is the automatic tail turret.

(Above right) The dark high sky and a decaying vapour trail silhouette the RB-66B's 35-deg swept wing. The camera and photoflash hatches in the belly are seen.

(Right) A pleasing over-cloud portrait of the RB-66B, forming a complementary study to the picture above it. Span is 72.5ft, and normal weight 70,000 lb.

"FLIGHT" photographs



"Flight" photographs

The 420th Air Refueling Squadron's KB-50 three-point probe-and-drogue tankers were converted by Hayes Aircraft Corporation. One reel unit replaces the tail turret and the other two are in pods outboard of the 500 U.S.-gal underwing tanks.

"NIGHT PHOTO JET" . . .

39,686 lb empty and has gross and overload weights of 70,000 lb and 79,000 lb respectively.

Though the aircraft may land at its gross weight, the touchdown speed in this condition would be as high as 160 kt. This is, of course, a quite abnormal case and the approach is usually made at 150 kt, leading to a touchdown at 115 kt. The combination of drag-chute, high-lift flaps, air-brakes and powerful disc wheel-brakes pull it up in quite a short space. The narrow-track main undercarriage seems to present surprisingly few problems. There is a slight, but not excessive, tendency to roll on the ground, but hydraulic nosewheel steering gives very good control. Steering is operated by the rudder pedals, a three-position switch allowing selection of "nosewheel free," "taxi" or "take-off" settings. In the take-off condition full rudder-pedal travel gives only ten degrees' deflection of the nosewheel. In cross-winds there is a distinct tendency to "bicycle," which means lifting one main wheel off the ground, but this is quite simply overcome by applying full opposite aileron. Each aileron is in two sections and a spoiler immediately ahead of the outboard flap section is mechanically interlinked with the ailerons on each side. The spoiler rises in direct angular relationship to the aileron itself and has its own hydraulic booster.

To cure pitch-up troubles which initially arose, and to give good low-speed handling, the leading edge outboard of the engine pylons is fitted with aerodynamically operated slats in three sections. The outboard section on each side opens progressively in turns at speeds below 300 kt and all slats are fully extended at about 180 kts.

All control surfaces are hydraulically boosted at a ratio of 25:1, and the tailplane incidence is changed by two electric jacks working together. The hydraulic power supply is duplicated, but neither pipes nor jacks have a stand-by. In case of malfunction, therefore, hydraulic boost is manually disconnected, but cannot be re-established in flight. Though stick loads are thereafter very high, the aircraft can be landed without difficulty. There are, in fact, two hydraulic pumps on each engine, one of each pair being regarded as a stand-by, but only a single pressure reservoir. The whole hydraulic system is divided into five circuits—"utility," serving undercarriage, brakes, nosewheel steering, airbrakes and flaps; "main emergency," providing photoflash release, undercarriage and airbrake standby; "aileron boost"; "rudder/elevator boost"; and the "alternate emergency," by which power from the boost circuits can be interconnected to the utility services.

The Douglas representative claimed absolute reliability for the aircraft systems; and the U.S.A.F. did indeed carry out a long test programme to establish this. The RB-66B's electrical system, by General Electric, is supplied by a 28 V D.C. generator and a 115 V, 400 c/s three-phase alternator at each engine. For all general services A.C. and D.C. are used in parallel, a particular example being the tailplane incidence-change. In this case both A.C. and D.C. jacks work together, the A.C. jack acting as a brake to the D.C. unit. With the former disconnected the tailplane can be freely moved by hand on the ground. But the A.C. jack gives five-times-faster tailplane incidence change. In two-and-a-half years of intensive testing no case of runaway has occurred.

The RB-66's crew compartment differs completely from that of its Naval A3D counterpart. Particularly impressive is the AiResearch air-conditioning system which uses a combination of compressor-bled and ram air and can reduce cabin temperature to as little as 45 deg F while the aircraft is flying "flat out on the deck." There are both water separators and a humidity control, and cabin temperature can be preselected by the pilot. The Americans described the degrees of snow and ice which the system could on occasion produce. Pressurization settings are 5 lb/sq in normally, and 2.75 lb/sq in for combat. The liquid-oxygen installation can provide pressure breathing; but this is not normally required, as the B-66 does not fly high enough. In addition, compressor-bled air is used for de-icing and anti-icing of the whole wing leading edge, tailplane and fin leading edges, engine pylons, nacelle forward sections and the main nose radome. With the system switched on the RB-66B can take off at full load, but it takes a little longer to get off the ground. Engine starting is by compressed air supplied from a small gas turbine in a ground trolley.

The large drag-parachute is deployed on every landing and though the aircraft can safely taxi with it attached, the chute is normally dropped at a designated pick-up point at the end of the runway to avoid unnecessary wear and tear. There are twelve attachment points for J.A.T.O. bottles on the aft fuselage flanks, but this assistance is for use only when the aircraft has landed on an airfield it cannot get out of again. The American pilots did not think that they could ever safely land on an airfield small enough to require assisted take-off.

The RB-66B is fitted with a Minneapolis-Honeywell autopilot which has a height and heading lock facility and normal knob control. It is not tied in with the camera installation, but can be coupled with I.L.S. for automatic approaches. At the moment the autopilot is little used, for flights are still fairly short, but the RB-66B has a marked panel on the right-hand side of the nose cone which indicates that an air refuelling probe may be fitted there. One of the aircraft at Sculthorpe actually carried the probe, and when this facility comes into general use for long flights the autopilot will come into its own.

With the RB-66Bs at Sculthorpe is the 420th Air Refueling Sqn., T.A.C., which has a mixed bag of KB-29 boom refuellers (for F-84Fs) and KB-50 three-hose probe-and-drogue refuellers. The probe-and-drogue aircraft were busily flying during our visit but we could see no receivers other than the RB-66s. It is unlikely, however, that more than two 66s would be able to contact the tanker at a time.

As for maintenance, the RB-66B appears already to be building up a fine record. The Douglas/U.S.A.F. reliability programme is paying off, and the Allison J71 10,000 lb thrust engines offer excellent accessibility. The complete underside cowling of each J71 pod hinges open and an engine can be changed in about five hours, although the job has been done very much more quickly. The J71 has a very large main rotating assembly with no fewer than sixteen compressor stages, but it is provided with an acceleration control which will take it from idling to maximum power almost as fast as the power lever can be moved. In the cockpit the pilot sits hard over to the left and holds the power levers in his right hand. The airbrake switch is incorporated in one of them and the braking parachute release lever is close by.

Altogether the RB-66B is well liked by its crews and the conversion programme is going well. The 19th Sqn. in any case should have no great difficulty with it since they have on four occasions won the U.S.A.F.E. tactical squadron proficiency award.

Though the U.S.A.F. originally hoped to buy the Naval A3D Skywarrior off-the-shelf with only six alterations, they ended up with over 400, including a two-degree change in wing incidence and a complete new fuselage layout. Add to this the B-66B bomber, RB-66B photographic and RB-66C radio reconnaissance versions, all radically different, and the B-66 became a full-scale development project. The result in terms of a series of weapons may or may not be considered worth many years of effort by the Douglas Long Beach Division and U.S.A.F.

C.M.L.

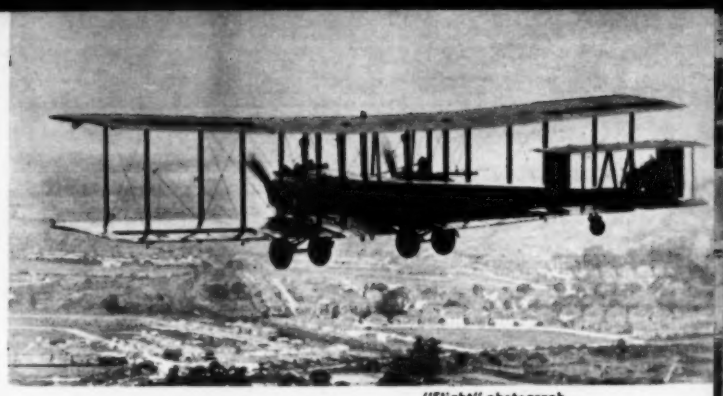
Drag-chute, flaps and air-brakes are all extended for normal landings. Starboard aileron and spoiler are here raised to counteract roll caused by cross-wind and narrow-track undercarriage. The drag-chute is housed inside the tail-barbette access hatch under the fuselage.

PROPHECY IN AERONAUTICS

A Study in Perspectives

Part II

By A. V. CLEAVER, F.R.Ae.S.



"Flight" photograph

PART I of this article appeared in "Flight" the week before last: Mr. Cleaver here continues his retrospective review of the book "The World, The Air, and the Future," written by Cdr. Sir Dennistoun Burney and published by Knopf in 1929.

SIR DENNISTOUN BURNEY was an advocate for all forms of air transport, but his chief enthusiasm, of course, was for the very large dirigible. To follow his R.100, he envisaged great fleets of commercial airships to ply the world's trunk routes, of more than twice the lifting capacity of R.100 and cruising at 90 to 100 m.p.h. with payloads of about 150 passengers and 20 tons of mail and freight.

Their most novel feature, as compared with the airships which will be remembered by all but our youngest readers, would have been their use of hulls of elliptical cross-section, to give them a much greater proportion of aerodynamic lift. With these, they would have operated almost entirely from water bases, with short take-off and landing runs, scooping up water into great floats to hold themselves down securely, and pumping it out to resume the airborne state. Other elaborate docking and mooring facilities were envisaged for surface handling.

Sir Dennis's general views are best indicated by the following quotations: "One result of our technical analysis of the situation has been to make clear that of the three types of aircraft, the airship will prove the most serviceable for long distance oceanic flights, the flying-boat for middle distances and the aeroplane (*sic*) for short land routes." Again: " . . . so far as one can gauge future possibilities, it is airships, and airships alone, that offer us a reasonable prospect of covering oceanic distances by air." As regards heavier-than-air craft: " . . . flying-boats admit of greater possibilities of development than do landplanes" because with "aeroplanes of 30 tons and over, their operation, except from water bases, will be so hazardous as to be impracticable from a commercial point of view."

Well, things could hardly have turned out more differently, only twenty-eight years after these predictions were made. It is only fair to say that there are at least two places in his book which suggest that Burney may sometimes have experienced an uneasy fear, a dimly-looming doubt, about the future of his beloved gasbags. (He never claimed anything but a civil rôle for them, except perhaps naval reconnaissance and anti-submarine duties, where they could be immune from aeroplane interception.) In one place, he writes, surprisingly, that "it is quite conceivable that, at some future time, airships will be entirely displaced by heavier-than-air craft." Once again, however, it was flying-boats that he had in mind, and even so he quickly adds "The time has not yet arrived, however, when we can construct flying-boats of this character, and whether such a time will ever come is at least problematical."

Elsewhere in the book, he again considers the life of the airship as a useful vehicle, and concludes that it "will last until such time as technical science can find a solution to those seemingly insoluble problems connected with the development of heavier-than-air craft. It is possible that these difficulties may one day be overcome, in which case the airship will be eliminated; and just as the Cunard Line was established with sailing vessels, which, as science developed, gave way . . . to steam . . . so, at some future date may an Atlantic Air Service, which began with airships, gradually, and as development proceeds, yield place to a service of giant seaplanes."

Two really striking facts emerge from all this. First, the developments which Burney obviously imagined would take several generations at least were actually well on the way to completion before very much more than a decade had passed. To the airship, it is true, fell the honour of carrying the first fare-paying passengers across the Atlantic. However, the day of the *Graf Zeppelin* and the *Hindenburg* was little more than a fleeting moment. Then came the Boeing, Sikorsky and Short boats, but they, too, enjoyed only the briefest of innings.

This was the second surprise; the pace of development has so vastly exceeded even the most qualified of Burney's reservations that the DC-7, the Constellation and the Stratocruiser of today, and the DC-8, 707, and Britannia of tomorrow have in turn disposed not only of the airship but of "the giant seaplane" as well.

Of course, there is a minority which would still claim otherwise, but the vindication of their hopes now seems very unlikely. Aquila Airways may awaken the sleeping Princess to run their specialized tourist service to lovely Madeira, but if anyone is to provide her with a great family of sisters, then even more surprising developments will need to transpire than those which proved Burney wrong in saying, not only that "the airship and the flying-boat are predestined to be the types of craft used for the great trunk routes," but also (and with great and repeated emphasis): "each will operate from a water base."

Burney's book does not suggest that he was unduly prejudiced, and he must have had access to all relevant information; he also sought the advice of the best available experts. In his consideration of heavier-than-air "difficulties and problems," he appealed to two outside sources. One was a committee of the U.S. Navy, which, only five years before (in 1924), had reported that "a plane weighing between 40,000 and 50,000 lb, with materials now known, marks a limit beyond which the increase of size would not be profitable." After a brief discussion of the square-cube law and other design considerations, the report continues "The present maximum performance of heavier-than-air craft may be increased about 30 per cent by future development extending over an indefinite period of time . . ."

The other expert source was none other than N. S. Norway, described as "chief calculator" on the R.100 design, and who previously "was for some years on the design staff of the de Havilland Aircraft Company." In more recent times, he has of course become better known as Nevil Shute, the best-selling

"Of all the temptations which beset the designer of aeroplanes," wrote an authority (himself a designer) in 1929, "this temptation to increase the minimum flying speed is the most insidious." The Vickers Virginia of circa 1929 (heading picture) landed at 50 m.p.h. The landing speed of the Convair B-58 (below) is at least three times as great.

"A plane weighing between 40,000 and 50,000 lb," reported a U.S. Navy committee in 1924, "with materials now known, marks a limit beyond which the increase of size would not be profitable." Loaded weight of today's B-52 is some ten times greater.

PROPHECY IN AERONAUTICS . . .

novelist to whom some have awarded the laurels of a prophet in his own right for his account of the troubles of the "Reindeer" in *No Highway*. (Most engineers, however, will prefer to regard the book just as a delightful entertainment which struck the authentic note of the aircraft industry its author knew so well; fatigue was not really first discovered by Nevil Shute, or by de Havillands with the Comet!)

Talented engineer and writer though he undoubtedly is, Nevil Shute Norway must have blushed if he has recently re-read the Chapter VI which he contributed to Burney's book. It opened with the somewhat condescending observation that "Because the speed of the commercial aeroplane today is equal to the maximum speed record of a few years ago, the forecast is freely made that within a few years passenger-carrying aeroplanes will be travelling at over 300 m.p.h., the speed record today." However, he would make an attempt to explain why "the commercial aeroplane will have a definite range of development ahead of it beyond which no further advance can be anticipated," so that "the reader may be in a position to discount the grosser of these journalistic exaggerations."

During the course of this explanation, he wrote (in 1929!): "The shape of the wing section will probably not be capable of any very great improvement." As an addition to the standard square-cube law arguments against any large increase in size, he stated that "finally, it must be remembered that the component parts of the machine must be capable of transport by road or by rail. In the case of a very large machine this will necessitate the construction of the structure in small units, which may add appreciably to the weight."

Best of all, to our modern eyes, is a discussion of landing speeds, which Shute (or Norway) thought might be allowed to rise to 60 m.p.h. for landplanes or 90 m.p.h. for flying-boats. However, this remark that "Of all the temptations which beset the designer of aeroplanes, this temptation to increase the minimum flying speed is the most insidious" will admittedly find a sympathetic reception from many of today's pilots; so also, very probably, will much of the general drift of the following account of experience on the early air routes, such as London - Paris:—

> "It was soon proved in practice that a machine with a minimum flying speed of 50 m.p.h. was safe . . . . In the next design of passenger machine the designer increased the landing speed to 55, at the same time asserting his opinion that 'the pilots would get used to it.' The pilots, on whose shoulders the burden of any increased danger fell, grumbled, but did in fact get used to it. For a further increase in efficiency the landing speed was put up to 60 in the next design; the pilots grumbled louder than before . . . . The next design increased the landing speed to 63 m.p.h. . . . . Serious trouble with the pilots marked the introduction of the new machine, but they submitted loyally to the judgment of their experts, and grew accustomed to the higher landing speeds . . . . But this was the end . . . . Finally, a bad crash . . . . brought matters to a head, and the type was abandoned."

After a somewhat cavalier dismissal of any major aerodynamic or propulsion advances, the author then assesses the likely ultimate standards of heavier-than-air craft. He considered these might be attained for flying-boats within twenty years (i.e., by 1949), and for landplanes within fifty (i.e., by 1979). However, in a footnote Sir Dennistoun begged to differ from his expert adviser, saying "I think progress will be much quicker in view of the unlimited capital available for development."

Passing quickly over the point that no aircraft constructor within living memory has ever found, or at least admitted finding, "unlimited capital for development," let us admit that otherwise Sir Dennistoun was more right than he ever dreamed could be possible. The full import of this cannot be absorbed without some idea of the sort of "ultimates" in question; on p. 301 of his book he tabulates them as follows:—

"Large Flying Boat.	Speed 120-150 m.p.h. Commercial range (i.e., stage-length) 1,250 mls. Pay load 10 tons. Total loaded weight 70-100 tons.
"Large Land Machine.	Speed 110-130 m.p.h. Commercial range 600 mls. Pay load 4 tons. Total loaded weight 20 tons."

Just for comparison, let us take a look at the rough specification of the intercontinental jet liners, which will be coming into operation about thirty years after Burney's book was written. Of course, their landing speeds will be much higher than Nevil Shute Norway thought would ever be safe—and not on water, either! In these days of sophisticated approach-aids and concrete runways two miles long, let us hope his misgivings on this score are no longer even partially justified:—

Speed	575 m.p.h.
Commercial range	3,500 mls.
Payload	15 tons
Total loaded weight	130 tons

Let us be grateful to Sir Dennistoun Burney and Nevil Shute Norway (both of them happily still with us), and to all the earlier prophets (unhappily not), from whose writings we have quoted so extensively, and from which we can learn such an object lesson. These critical comparisons, drawn so long afterwards, were certainly not intended in any mere spirit of mockery. It is so easy to be wise after the event, and the present writer, especially, has been very conscious throughout of the many predictions he has personally made about the future of rocketry and spaceflight . . . how silly will these look, one wonders, in ten, twenty, or thirty years time?

Nevertheless, the following conclusions and comments, intended to be constructive, are tentatively offered for the guidance of any future pundits who may be prepared to stimulate us by sticking their necks out:—

(1) It is highly dangerous to make negative predictions, at least unless some very fundamental law, such as the conservation of energy, is involved. (And when I once mentioned even this reservation to a physicist, he replied, disconcertingly, "Well . . . . ?")

So, let all those beware who decry the case for the wider civil use of pure jets rather than turboprops, or for jet lift, or—one day—nuclear-powered aircraft, or the ICBM and its spaceship descendants!

(2) Long-term predictions based on the "unsound" or "journalistic" approach have a disconcerting tendency to prove more reliable, in the long run, than many of soberly-skilled expert origin—and the "long run" is often surprisingly short.

This really amounts to saying that what is needed, above all, is imagination—an observation which should not be taken to imply support for the view, to which so many British managements have clung for too long, that some sort of divine native inspiration is a complete substitute for large staffs, the computers and the test facilities of our American competitors. However, within reason it seems better to prophesy from an attitude of: "If we could halve the drag, let's see how worthwhile it would be; if it is, then somehow we'll probably achieve it—and let's consider how," rather than, more pedantically: "There is reason to believe drag could be reduced by 10 per cent without recourse to any speculative methods, so let's see what we could do then."

Furthermore, the imagination should be carried all the way through. For example, with Burney's faith in the world's need for military and civil aviation, was it so difficult to foresee that it would be prepared to build expensive bases, with long, strong, flat runways from which big landplanes could operate?

(3) Due allowance should always be made for the likely advent of radically new techniques and developments, even when these cannot be foreseen in detail, providing that there exist social demands (civil or military) to foster them; between the wars, the gas turbine and jet propulsion might be regarded as examples of what is meant. Today, some radical form of nuclear reactor applied to a jet-lift aircraft might be.

However, it is at least equally important (and certainly much easier) to allow for the *cumulative* effect of a great many more orthodox detailed improvements.

It was on this latter score, rather than the former, on which the technical predictions of, for example, Norway in Burney's book, fell down. The use of flaps, variable-pitch propellers, supercharging, retractable undercarriages, low-drag wings, stressed-skin cantilever monoplanes built with better aluminium alloys, pressure cabins—all these things in combination—would have made nonsense of the landplane limitations then foreseen, even without the advent of the gas turbine. And, of course, mention must again be made of the freedom to employ higher wing loadings conferred by the provision of long, strong runways.

With all these thoughts in mind, let us hope that someone will soon produce, some thirty years later, another book as interesting and stimulating as Sir Dennistoun Burney's was in 1929. Any intending author would do well to remember, too, one final quotation from his wise introductory disclaimer: ". . . it must not be supposed that I wish anywhere to insist on the infallible rightness of my own opinions on the various controversial topics with which the air problem bristles." This advice, at least, has stood the test of time—and the present writer would certainly like to associate himself with it.

Canware from Burnley

Gas-turbine Component Production and Repair by a Specialist Firm

Assembly of "one off" components by skilled craftsmen in progress in the specialized-development and prototype department.

THE old Lancashire town of Burnley is, and has been for a century and a half, famous as a source of manufactured textiles. It is also (writes a member of *Flight's* staff after a visit to Burnley Aircraft Products, Ltd.) the fountain and source of one of Britain's many gas-turbine sub-contract streams, whose confluence is the final assembly line.

Burnley Aircraft Products, who celebrate their twentieth anniversary this year, have been supplying fabricated sheet-metal components to the aircraft industry since 1937. Nowadays they are regarded by the engine industry as specialists in anything that comes under the broad general heading of "turbine engine canware." They fabricate in quantity not only new components—jet-pipes, flame-tubes, air intakes and so forth—but are major repair contractors as well, and the whole of one of the firm's three factories is devoted to this work. In 1956 this one factory repaired and put back into service more than 20,000 flame-tubes alone—each for about one third of the cost of a new component.

The materials principally used in the company's work are stainless steel, Inconel, Nimonic and, to a lesser extent, mild steel and aluminium alloys.

The three factories in Burnley—one of which was only recently opened—occupy a total floor area of half-a-million square feet. There is an associated company in Canada—the Renfrew Aircraft and Engineering Co., Ltd., of Ontario. Each factory at Burnley gives an immediate impression of orderly hustle: layout is compact and geared for quantity production. They are exceptionally well equipped with up-to-date machine tools and other equipment—especially for welding, a branch of the canware art in which especial pride appears to be taken. All types of welding processes, including spot, stitch, seam-resistance, and Argonarc, are employed. All machines have full synchronous electronic control (to ensure accurate regulation of weld-time and current-cycles) and are fitted with high-lift, short-stroke, constant-pressure heads of the firm's own design.

The company's checking and inspection system is meticulous even by aeronautical standards: all materials are checked in the laboratory against their specifications, both chemically and physically; weld settings and techniques, and all production processes, are checked prior to production-runs; and, of course, finished components are scrupulously inspected before delivery.

A small but very important department of the firm is devoted to production development-work, to make certain that new processes are developed and ready not only to improve existing production techniques but also to ensure that the art of quantity canware production is always moving with the times.

The upper view shows a section of the press shop. Power presses range from 250-ton hydraulic types to a battery of light machines.

(Left) Flame-tubes and similar components are reconditioned in large quantities. Last year 20,000 flame-tubes were repaired and put back into airline and military service.

Part of the fleet of the Royal Singapore Flying Club, whose new club-house was opened (right) by the Governor of Singapore (see first news item).

CLUB AND GLIDING NEWS

THE new club-house of the Royal Singapore Flying Club at Singapore Airport was opened by the Governor, Sir Robert Black, K.C.M.G., O.B.E., at the end of last month. This occasion, together with the recent grant of financial aid from the Government of Singapore, marked the culmination of a long struggle to ensure the continued existence of the club, which was formed in 1928 with one D.H. Moth seaplane.

The "Royal" prefix—a source of great pride to the club—was granted by King George V in 1931, on the recommendation of the then Governor, Sir Cecil Clementi. At the outbreak of the second world war, the club was based at Kallang Airport with a mixed fleet including a Moth Minor, a Hornet Moth and a Whitney Straight. These aircraft, together with most of the club members, were subsequently absorbed into the Malayan Volunteer Air Force and rendered gallant service during the closing stages of the battle for Malaya and Singapore.

In 1947 the club was re-formed with the aid of a war-damage grant, and flying started again with ex-R.A.F. Tiger Moths. When Kallang was closed at the end of 1955, members and staff set to and built themselves a club-house and hangar at the new city airport at Paya Lebar. The result of their labours was reflected in the total of 1,387 hours flown by the club during 1956.

Shortly after the opening of the club-house a Hindustan Aircraft H.T.2 was handed over to the club. This machine, believed to be the first British-registered H.T.2 to fly in the Commonwealth, has been loaned by the Indian Government under the terms of the Colombo Plan and will be used for the training of local youths.

Two Chipmunks are now on order. Other aircraft in the club's fleet are two Tiger Moths, two Austers and one Cessna 170. President, captain, and honorary C.F.I. of the club at present are respectively Capt. P. J. White (Malayan Airways), F/L. D. I. Fairbairn (R.A.F.) and Mr. J. H. Wagstaff (Director, Telecommunications, Malaya).

FORMATION of a new co-ownership group is planned to operate a Super Aero 45 light twin from Croydon. Interested pilots should contact Capt. E. S. Davis, 16 Fountain House, Park Street, London, W.1.

RECENTLY announced by the Plymouth Aero Club is the "Mayflower Air Rally," to be held at Roborough on April 13-14, 1957. Organized with the co-operation of Project Mayflower, Ltd. (the body responsible for construction of the *Mayflower* replica), the rally will include a time-of-arrival competition, *concours d'elegance*, conducted inspection of the *Mayflower* replica, reception and dance at the club-house, "aerial tour of the environs of Plymouth with a farewell salute to the *Mayflower* and (should sailing date coincide) an air escort for the ship out of Plymouth Sound," and a coach tour of Plymouth.

INSTRUCTIONAL flying at the Northamptonshire Aero Club during the last year exceeded by a handsome margin (and for the first time) the 1,000-hour mark. This was reported at the recent a.g.m. at Sywell by the chairman of the club, Alderman C. M. Newton, M.B.E., who went on to congratulate the chief flying instructor, Mr. L. C. Hilditch. Fifteen private pilots' licences had been gained during the year and 73 members had flown solo. The club's annual flying competitions had been won by K. E. Corbett (best student pilot), J. W. Kingston (navigation), J. A. Wardley ("Find your way home" contest and championship cup) and J. Beaty (general flying).

EXETER Aero Club members have flown over 600 hours during the six-months' period ending last month. First solos have been logged by Messrs. Austin, Purchase, Kemp, Rowland, Bradshaw, Barr, Gillard, Burton, Hartle, Butler, Mrs. King and Miss Somerville; and P.P.L.s have been obtained by Messrs. King, McFarlane, Ashcroft, Groves, Jarman, Kemp, Gage and Rowlands. Messrs. Innalls, King and Heelas are now chairman, flying committee chairman and C.F.I. respectively. "Extra-curricular" activities at Exeter are numerous; they include those of three squash teams, a dramatic section (now busily rehearsing for "Ladies in Retirement"), and an active social programme, while it is hoped that a new tennis court will be in use this summer.

BRITISH gliding awards for 1956, presented to the winners by Lord Brabazon at the B.G.A. Victory Ball on March 15, went to the following pilots:—

De Havilland Cup for greatest gain in height: David Kaye, Derby and Lancs Club; 14,200ft during Camphill-Newcastle flight on October 21.

Manio Cup for best goal flight: Sgt. John Williamson, R.A.F., Army Gliding Club; 196 miles from Farnborough to St. Davids in a Weihe on May 22. *Hon. mention:* P. Bisgood, E.T.P.S., 194 miles from Long Mynd to Great Yarmouth on May 23.

Wakefield Trophy for longest distance: Sgt. A. Gough, R.A.F.G.S.A. Wessex Club; 199 miles from Andover to Grassington on May 21. *Hon. mentions:* P. Bisgood and J. Williamson, as above.

Volk Cup for best "out and return": David Ince, Surrey Gliding Club; 132 miles, Lasham-Stanton Harcourt-Lasham on May 20.

Seager Cup for best two-seater performance: Derrick Goddard and Ted Hargreaves, Surrey Gliding Club; 84 miles, Petersfield-Lewes-Petersfield in a Gull II on April 28 (U.K. two-seater goal and return record). *Hon. mentions:* (1) D. Piggott and V. Alexander, Surrey Gliding Club; 100 miles, Lasham-Dunstable-Lasham in T.42 Eagle on May 20; (2) Dr. B. James and Miss Jill Walker, Surrey Gliding Club; 11,400ft gain of height in Gull II from Lasham on July 18).

California in England Trophy for longest-distance flight by a woman pilot: Dr. M. Gilbert, Imperial College Gliding Club; 98 miles from Lasham to Castle Bromwich on July 11.

Douglas Trophy for largest cross-country mileage on three members' flights from one club: Surrey Gliding Club, 493 miles (David Kerridge, 173 miles from Farnborough to Login on May 22; Derrick Goddard, 155 miles from Lasham to Dinas Mawdwy; John Mackenzie, 165 miles from Lasham to Tonbridge *via* Cirencester).

At the annual general meeting of the British Gliding Association, held in Londonderry House, London, on March 16, the chairman of the association, Mr. Philip Wills, reported another year of growth—limited only by the physical capacity of most of the clubs to take on new members.

A record number of long-distance flights had been achieved during the past year, the report continued, including nine "Gold C" distances, of which five qualified for the 300 km goal-flight "diamond." The total number of hours reported by the clubs was 15,726, associated with 99,429 launches; these figures showed an increase of 956 hours and a decrease of 195 launches compared with those for last year. In addition, the Air Training Corps had logged 5,186 hours and 65,200 launches.

The Kemsley Flying Trust had approved new loans for clubs and private-member groups to the extent of £16,465 during the year. The establishment of permanent gliding centres was the first consideration of the trustees and two such projects were under consideration.

Reporting on the work of the council, the chairman said, "In the latter part of the year, we did much work towards a revision of the proposed new airways and control zones which the M.T.C.A. plan to introduce in 1957 and 1958 to cope with the increasing flow of air traffic. We managed to improve the position of the London Gliding Club by getting them out of the London Control Zone, but were faced with a more intractable problem in the case of the Derbyshire and Lancashire Club at Camphill. The new plans envisage the creation of an airway directly over the site and, at the present time, the maximum concession offered has been to investigate the possibility of lifting the base of the airway from the original figure of 3,000ft a.s.l. (only 1,600ft above the site) to 5,000ft a.s.l. . . ."

The general problem of airspace restrictions was discussed following a resolution from the London Gliding Club "that the meeting is gravely concerned at the restrictions on freedom of glider flying arising from controlled airspace and strongly urges the council to continue and expand its activities directed towards achieving a greater degree of freedom in this respect." The resolution, put forward by Mr. Godfrey Lee, was carried.

During the informal discussion which followed the meeting, it was announced that the principle of an allocation of petrol in connection with this year's national gliding championships at Lasham had been agreed. It was hoped that the championships would feature launching by aero-tows.

FROM April 1, the Kronfeld Club, 74 Eccleston Square, London, S.W.1, will be open from 6.30 p.m. each evening from Monday to Friday, with talks and film shows continuing on Wednesdays.

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D.H. Results

FINANCIAL results in the de Havilland group of companies for the year ended September 30, 1956, issued last week, show a net surplus, after provision for all charges except U.K. and overseas taxation, of £3,846,338 (1955, £2,570,954). Taxation absorbs £2,190,767 (1955, £1,579,276).

de Havilland Holdings, Ltd., state that the increased surplus has, to a considerable extent, been due to the excellent results of the Canadian subsidiary company.

A dividend of 7½ per cent on the Ordinary stock is recommended.

English Electric Report

SPEAKING about the aviation activities of the English Electric group at the company's annual general meeting on March 14, the chairman, Sir George H. Nelson, said that over 750 Canberras had been built in this country, more than 350 under licence in the U.S.A. and a further number in Australia. Intensive development of the P.1 had proceeded during the year and had resulted in a considerable production order for early delivery.

Throughout the past year English Electric work on guided weapons had made excellent progress, and through the years the strongest of foundations had been laid. The company was spending further large sums of money on research equipment applicable to both aircraft and guided-weapon design. During the past year work had begun on new high-speed wind tunnels.

Of aircraft electrical equipment, Sir George said that during 1956 the most advanced high-altitude chamber and dynamometer laboratories for research into and testing of such auxiliaries had been brought into full operation.

Referring to the products of D. Napier and Son, the chairman remarked that the Eland turboprop had passed its type-test during the year and continued to build up essential flying experience in three aircraft converted for that purpose—a Varsity, an Elizabethan and a Convair 340. Very satisfactory progress had been made with the company's latest engine, the free-turbine Gazelle for helicopters. This had been selected by the Royal Navy to power the Westland Wessex and by the R.A.F. for the Bristol 192.

Reviewing the work of Marconi's Wireless Telegraph Co., Ltd. (another member of the English Electric group), Sir George said that their pilot-operated communications equipment had been ordered for Bristol Britannias, and the company had been entrusted by B.O.A.C. with the preparation of a radio system for Comet 4s.

Sir George mentioned finally that Marconi A.D.F. and radar equipment had been installed on numerous airfields.

Making Photographic History

THIS year's annual dinner and dance of the Williamson Manufacturing Co., Ltd., in London on March 15, held a special significance for the chairman, Mr. C. M. Williamson, C.B.E., F.R.P.S., for (to quote his own jocular remark) he was "entering upon the first year of his second half-century" with the company founded by his father in 1886.

Looking fit and well after recovery from a recent illness, Mr. Williamson told his audience—the firm's employees (whose individual length of service, incidentally, averaged over 20 years)—that, with the Willesden factory newly extended, the business was now entering upon a new era of keen competition. He believed that aerial cameras had reached the ultimate limits of complexity and weight, and that simplification of design and "the adding of more lightness" was now the real objective.

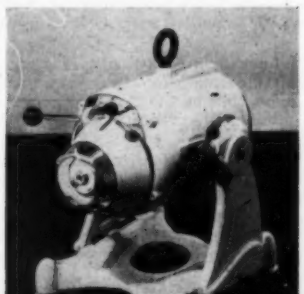
He recalled his experiments in World War I, when "we went down to the coast in a single-engined biplane and if we were lucky came back with fifteen photographs taken from 2,000ft." Today, he went on, two of the company's specialists, Ian Hunter (development engineer) and Murray Taylor (flight observer) would go down to the coast—the Mediterranean coast—and return with thousands of exposures from several miles high—"the finest air pictures made by any photographers in the world." In some of them, he added, it was possible to count the links in a ship's anchor chain.

Mr. J. E. Odle, F.R.G.S. (joint managing director) said that in view of the present uncertainties of aircraft development it was good to know that aerial photography remained a priority requirement; an air commodore had just been appointed to take charge of such work in the R.A.F. [an allusion to the establishment of the new Central Reconnaissance Establishment, under the command of A. Cdre. D. S. Radford]. Incidentally, added Mr. Odle, the company's "non-aviation" orders stood at a healthy level.

In conversation later with Mr. Williamson, we induced him to say more about the early days. Fascinated by photography since boyhood—at the age of 12 he had assisted William Friese-Green, the pioneer cinematographer—he made his first successful experiments in aerial photography from a Vickers Gun Bus at Farnborough in 1915. He subsequently developed the first automatic film camera, the Williamson F.1. Plate cameras were used during the 1914-18 war, but shortly afterwards the Air Ministry went over to film, and the F.1 was adopted as the prototype for the series of automatic film cameras which followed. At a later period in his work Mr. Williamson made a series of experimental photographic flights, in an Avro Avian, with the famous F. P. Raynham, who died in 1954.

Radioactive Inspection

WASTE products from uranium fission at Calder Hall atomic power station are highly radioactive and can be put to industrial or medical use. For example, radiation emitted by caesium 137 can be used like that from an X-ray machine for the inspection of castings and welds; and such applications are made practicable with radiographic units of the type



Equipment made by Nuclear Engineering, Ltd., for the remote handling of radioactive materials.

built by Nuclear Engineering, Ltd., Greenwich Metal Works, London, S.E.7. One advantage of this form of inspection is that since radiation is emitted continuously in all directions, a large number of different objects can be examined simultaneously, thus saving production cost and time.

The geometrical dimensions of a typical source are of the order of ¼in, and its penetrating power roughly the same as that from a one-million-volt X-ray tube. It is suitable for the inspection of ferrous materials in the ¾in to 4in thickness range.

In the Interests of Service

IN 1949 the service managers of seven leading British airframe and engine firms co-operated at the suggestion of Mr. W. P. Calvert, at that time service manager of Rolls-Royce, to form an association whose aim was to take care of the interests of British service engineers in the field—with particular reference to their allowances, income tax, medical problems, and so forth.

This group, the Association of Aero Service Managers, has had Mr. Calvert as its chairman since that time. He has now been appointed manager of the Rolls-Royce Australian company (see *Flight*, January 25), and at a meeting in London last week the Association gave a small luncheon in his honour and presented him with an engraved silver salver. To succeed him as chairman the Association unanimously elected Mr. S. H. Sharp, service manager of the de Havilland Engine Company.

Automatic Warnings by Telephone

AN "Auto Call Telealarm Repeater Unit" which gives warning, over existing G.P.O. telephone lines, of a fault or breakdown in an essential service on unattended premises, has been developed by the Auto Call Co., Ltd., Security House, 40-42 Parker Street, Kingsway, London, W.C.2.

The device, operated by a 12-volt battery, repeats a recorded message for a period of four minutes, then closes down; if the line is engaged, it waits four minutes before making another call. It can make four such calls at four-minute intervals; and the designers believe it unlikely that with such an operating cycle, covering 28 minutes, a message would fail to get through.

Mr. H. R. Haynes

THE Microcell group of companies recently announced "with deep regret" the death of Mr. Henry Richard Haynes, A.F.R.Ae.S., their chief projects designer.

Mr. Haynes, who was 57, spent his whole working life in the aircraft industry. He received his training at the Royal Aircraft Factory, Farnborough, from 1913 to 1918 and in the latter year became a junior draughtsman with W. G. Tarrant and Son, Ltd., Byfleet (who at this period were building the 131ft-span Tarrant triplane). Thereafter he held appointments with Vickers and Fairey, and was subsequently associated with W. G. Carter in the design of the Short Crusader seaplane.

In 1928 Mr. Haynes joined Handley Page, Ltd., as a senior draughtsman, later becoming an assistant designer; between then

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and 1945 he was concerned with design work on the Hannibal, Hampden and Halifax, and the early stages of the Victor. In 1947 he joined the de Havilland Aircraft Co. as a senior design draughtsman and worked on the D.H. 110. Mr. Haynes took up his appointment with Microcell in 1952.

IN BRIEF

Mr. F. S. Codling, A.R.Ae.S., has been appointed managing director of Airtech, Ltd. Mr. G. Talbot Willcox, M.C., M.Inst.T., continues to hold the appointment of chairman.

* * *

Mr. Derek Foster has been appointed sales liaison manager for the Owen Organization and will operate from Owen House, 11 Greenfield Crescent, Birmingham, 15 (tel. Edgbaston 4566).

* * *

The Champion Spark Plug Co., Toledo 1, Ohio, U.S.A., is sponsoring a European aircraft spark plug and ignition conference, to be held at the Kensington Palace Hotel, De Vere Gardens, London, W.8, from May 21 to May 23.

* * *

Next Monday, April 1, Hepworth and Grandage, Ltd., the Bradford, Yorks, makers of internal-combustion and gas-turbine engine components, celebrate their golden jubilee. Among the company's 4,000 employees are several who joined soon after its inception in 1907 and over 130 who have been there more than 25 years.

* * *

Mr. W. R. McLachlan, president and general manager of Orenda Engines, Ltd., has announced the following executive appointments: Mr. Frank L. Trethewey has been named assistant to the president and continues as a director of Orenda Engines, Ltd.; Mr. Paul Y. Davoud has been appointed vice-president, sales and service; Mr. Kenneth R. Church has been appointed vice-president, finance and treasurer; and Mr. John H. Ready has been appointed secretary.

* * *

Mr. F. Andrew Field, home sales manager of Black and Decker, Ltd., since 1953, is leaving to take up the appointment of managing director of Eutectic Welding Alloys Co., Ltd.

* * *

Heenan and Froude, Ltd., have received an order from Rover (Gas Turbines), Ltd., for 18 DPX2 dynamometers which will be incorporated in demonstration units for use in universities and technical colleges.

* * *

The use of aerial photography, of the airborne magnetometer and of helicopters as additional aids in the never-ending quest for new oil deposits are described in *The Search for Oil*, an informative booklet published by the British Petroleum Co., Ltd., Britannic House, Finsbury Circus, London, E.C.2.

* * *

An electronic analogue computer designed and built by Shorts Brothers and Harland, Ltd., was recently installed at Brunswick Technical College. This follows the demonstration given there by Mr. Peter Wright, Shorts' sales engineer, to representatives of West German universities and industrial concerns; and already other orders have been received from Germany.

* * *

Three divisional directorships have been created at the Minnesota Mining and Manufacturing Co., Ltd. Mr. H. B. Kosanke becomes director of the tape and electrical products division, Mr. I. R. Danielson of the graphic arts division, and Mr. A. C. Ash of the abrasives and adhesives division. Two other appointments announced are of Mr. J. A. Thwaits as director of engineering and Mr. J. F. Fowler as director of production staff services.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

No Manual Reversion

ON your Correspondence page for March 15 is a letter in which Mr. R. S. Stafford points out that Handley Page, Ltd., flew aircraft with fully duplicated power controls and without manual reversion before the Fairey Delta 2 began to fly.

A. V. Roe and Co., Ltd., flew aircraft with such controls even before Handley Page, but, to use Mr. Stafford's own words, "in the interests of accuracy," have not made any rash claims on that score. I am sure Mr. Stafford will find if he cares to check that there is yet another British company who can make claim to being first in this field if they wish to do so.

Manchester. JOHN R. GRAY,
A. V. Roe and Co., Ltd.

IN your issue of March 15, 1957, it is stated by Mr. R. S. Stafford, Technical Director of Handley Page, Ltd., that his company has flown aeroplanes with fully duplicated power controls and without manual reversion since 1952.

Whilst agreeing that there may be no particular virtue in being first in this field, I also think that in the interests of accuracy it should be stated that the de Havilland Comet prototype G-ALVG flew with duplicated power controls without manual reversion on July 27, 1949, and Comets have been flying with this type of control ever since.

Hatfield, Herts. C. T. WILKINS,
Chief Designer, the de Havilland Aircraft Co., Ltd.

York Accident—Malta

THIS Association must comment on the references made on page 289 of *Flight*, March 1, to its statement on the Malta York accident.

We wish to point out that the aircraft did clear the high ground on its track. *Flight* states ". . . the pilot was unable to clear the high ground on the track being flown."

When studying the accident the Association was concerned with the performance of the aircraft, such as insufficient rate of climb and the conditions which obtained at the time of the accident, which placed the pilot in an invidious position as he had no room to manœuvre in the vertical plane.

London, W.1. L. F. E. COOMBS,
Technical Secretary, British Air Line Pilots Association.

"Cock-eyed World"

IN publishing the photograph of the "nose-standing" airship (page 328, *Flight*, March 15), aren't you kidding us? Admittedly the camera is alleged to be a paragon of veracity—although the R.A.C., A.A., and motoring journals are trying, very successfully, to debunk the camera in connection with recent photographic activities of the police. I am, however, very loath to accept John Toland's (or *Flight's*) opinion that the *Los Angeles* was in fact standing on its nose when the photograph was taken. I think it is just a Yankee "bull" story.

If any aspect of the dirigible other than the square-on underbelly shot had been taken, I might have believed it. In actual fact, I think the dirigible was lying almost perfectly horizontally and that the photographer was standing beneath it and behind its stern. In the first place, the definition of the tower, building and background is very poor, and yet the higher up the picture one gets the clearer it becomes (note the shadows from the engine blisters on the left hand [port] side and the clear lines of the ribs). If the dirigible was standing on its nose, as suggested, no part of it could possibly be any clearer than the tower.

Furthermore, the proportions of the aircraft and tower are such that if the dirigible was 700ft long and standing on its nose, the tower was only 150ft high and the building, to the ridge, less than 15ft high. I have an idea, subject to correction, that the New Jersey tower was in the region of 600ft high.

Sutton Coldfield, Warwicks. H. N. WALKER.

[In consultation with photographic experts we have carefully studied the print from which the block was made, and there is no evidence of faking of the kind our correspondent suggests. Had a wide-angle lens been used, some distortion of the outline would almost certainly have been apparent. The varying sharpness of detail was caused by the fact that slight retouching was necessary, in the normal way, before reproduction of a rather poor print. Mr. Walker's comparison of length defeats his own argument: a contemporary description gives the height of the U.S. Navy's Lakehurst, N.J., mast as 165ft (the world's tallest at that time), which scales well enough with the length of the airship on the photograph. It is apparent that the *Los Angeles* was not quite vertical. Perhaps American readers can confirm.—Ed.]

Identification Wanted

ON January 13 my attention was called to an aircraft flying in a north-westerly direction over Swansea Bay. Its unusual feature was an extremely long nose which seemed to be "nipped in" just forward of the leading edges, as if area-ruled. The aircraft had four engines, which sounded as if they were turboprops, and a high curving tail fin in the Boeing style (B-17, etc.). I would welcome any information on this aircraft, however small. It was flying at about 5,000ft and appeared to be silver overall.

Swansea. R.C.W.

[Parts of this description suggest the Boeing YC-97J.—Ed.]

A Hunter F.2 of No. 257 Sqn., on exchange with a Belgian squadron, unsticking from R.A.F. Wattisham last week, with the wheels of a formating Hunter just visible. Below, G/C. R. J. Gosnett, the station commander (left), and W/C. J. A. Sowrey, w/c. flying (centre), with Cmdt. R. J. E. Corbeel of the 7th Sqn., Chievres, after the arrival of the Belgian Hunters.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Australian V.C.A.S. Appointed

AN Air Ministry announcement last Monday stated that Her Majesty the Queen had approved the appointment, in September, of A.V-M. E. C. Hudleston as Vice-Chief of the Air Staff with the acting rank of air marshal. He will succeed Air Chief Marshal Sir Ronald Ivelaw-Chapman, who is being placed on the retired list.

A.V-M. Hudleston, an Australian, is the first of his nationality to have been appointed Vice-Chief of the Air Staff.

Standard Presentations

THE Duchess of Gloucester is to present a Standard to No. 58 Squadron at R.A.F. Wyton on Friday, June 28. The squadron invites former members to attend the ceremony, and those wishing to do so should communicate as soon as possible with the Adjutant, No. 58 Squadron, Royal Air Force, Wyton, Huntingdonshire.

On April 30, Air Chief Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command, is to present a Standard to No. 111 Squadron at R.A.F. North Weald. Former members wishing to attend should communicate with the Adjutant, No. 111 Squadron, Royal Air Force, North Weald, Epping, Essex.

Royal Messages to Reserves

AFTER the Queen and the Duke of Edinburgh had received more than 80 commanding and senior officers of the R.Aux.A.F. and the Air Divisions of the R.N.V.R. at Buckingham Palace on March 16 to mark the disbandment of those branches of the Services, each officer was given, on leaving, a signed copy of a message from the Queen.

The message handed to the R.Aux.A.F. officers read as follows:—

"I have welcomed this opportunity of taking leave of the commanding officers and senior auxiliary officers of the squadrons of the Royal Auxiliary Air Force which are being disbanded and of sending through them this message of appreciation and thanks to all their officers, airmen and airwomen.

"The history of the Auxiliary Air Force has been a glorious one. The first Auxiliary squadrons were included in the air defence of Great Britain in 1925. By the outbreak of war in 1939 the Auxiliary fighter, coastal and balloon squadrons formed an integral and vital part of our forces. It was aircraft of these squadrons which shot down the first enemy bombers over this country; and Auxiliary squadrons were heavily engaged in the air over Dunkirk and throughout the Battle of Britain. Later they were to win battle honours over the Atlantic, in Malta, North Africa, Sicily and Italy, the Arakan and Burma, and in Normandy, France and Germany.

"After the war the fighter squadrons were reconstituted as the Royal Auxiliary Air Force, and the traditional spirit of voluntary service found new outlets with the formation of A.O.P. and field squadrons, fighter control and radar reporting units, some of which are to remain in being and provide further opportunities for voluntary service.

"The association of the force with my family has always been close. I was proud to become Honorary Air Commodore of Nos. 603, 2603 and 3603 (City of Edinburgh) Squadrons in 1951 and to succeed my father as Honorary Air Commodore-in-Chief of the Royal Auxiliary Air Force in 1952. Members of my family have always treasured their association with Auxiliary squadrons as honorary air commodores.

"I wish as Air Commodore-in-Chief to thank officers, airmen and airwomen of the Royal Auxiliary Air Force for all that they have given to the service of the country by their enthusiasm, their spirit and their devotion to duty in peace and war. It is a sad day when it is necessary to tell so many that it is no longer possible to use their services on the duties they have assumed so willingly. I wish them to know that they can look back with pride and satisfaction to service well done."

The Queen's message to the R.N.V.R. air divisions read as follows:—

"Nine years ago a small number of experienced pilots and observers, who joined the Fleet Air Arm during the Second World War, and many of whom saw operational service, formed the nucleus of the air branch of the Royal Naval Volunteer Reserve.

"During these nine years some of the veterans gave way to younger officers who had gained their flying badges during their national service in the Royal Navy, and the air branch progressed from Seafires and Fireflies to modern aircraft. The Royal Naval Volunteer Reserve air squadrons had grown up to be a valuable part of our naval air power.

"I remember clearly the impressive fly-past by the Fleet Air Arm at the Coronation naval review, when many of the aircraft taking part came from the R.N.V.R. air squadrons, and the fly-past on the occasion of the 50th anniversary review of the R.N.V.R.

"The high proficiency which the R.N.V.R. air squadrons have always displayed could only have been reached by the enthusiastic hard work of all volunteer officers and ratings, and it is a sad day when it is necessary to tell so many that this hard work and efficiency can no longer be used.

"I wish most sincerely to thank all those officers and ratings whose devotion to duty and untiring voluntary efforts contributed to the

Air Marshal Sir Francis Fressanges, C-in-C., Far East Air Force, placing a wreath on the Singapore Memorial after its unveiling by the Governor of Singapore, Sir Robert Black. It bears the names of 24,000 members of the Commonwealth forces with no known grave.

Air Chief Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command (far left), and Air Chief Marshal Sir Claude Pelly (left), Controller of Aircraft, Ministry of Supply, whose promotion to their present rank — w.e.f. February 14 — was recently announced.

A.V-M. E. C. Hudleston (right) who—as recorded on page 421—becomes Vice-Chief of the Air Staff in September and the first Australian to hold that post. Since February last year he has been R.A.F. instructor at the Imperial Defence College and was previously A.O.C. No. 3 Group, Bomber Command.

SERVICE AVIATION . . .

value of the R.N.V.R. air branch. All can look back with pride on service well done.

"I am glad to hear that many are transferring to other duties in the R.N.V.R. It is a source of great satisfaction to me that the voluntary spirit which has always so strongly animated the Air Branch will in this way continue to serve the country."

Senior Appointment

AN Air Ministry announcement says that Acting A.V-M. John Marson has been appointed Director-General of Technical Services, Air Ministry. President of the Ordnance Board since March 1956, and previously vice-president from February 1954, A.V-M. Marson was before that A.O.C. No. 42 Group, Maintenance Command, from January 1951.

Army Air Force

SPEAKING in the House of Commons recently on the Army Estimates, the Secretary for War, Mr. John Hare, said that the Army would shortly take over from the R.A.F. full responsibility for aircraft used by them for observation, communications and other rôles with a maximum all-up weight of 4,000 lb.

Light aircraft were required by the Army in increasing numbers for such duties; hitherto Army pilots had flown them under the technical control of the R.A.F., but as in future the latter would be much less concerned with small piston-engined aircraft this new arrangement—to include Skeeters as well as Austers—had been made and details were being worked out.

Supersonic Minister

ON March 22 the Air Minister, Mr. George Ward, flew at supersonic speed for the first time, in a Hawker Hunter T.7 piloted by "Bill" Bedford, Hawker chief test pilot. The flight was made from R.A.F. Boscombe Down, Wilts, and the high-speed dive began at 40,000ft over the Channel off the Isle of Wight. Special permission had been obtained from the Ministry of Supply.

Sycamores' Jungle Record

FIVE Sycamores of No. 194 Sqn. recently set up a new squadron record in Malaya during a troop-lifting operation in the Cameron Highlands area, conveying 100 fully-equipped soldiers of No. 22 Special Air Service Regt. into and out of deep jungle in less than 3½ hours' flying time. This is the first occasion on which No. 194 Sqn. has carried out such an operation, as troop-lifting on a large scale is usually done by Whirlwinds of No. 155 Sqn.

Normally based at R.A.F. Kuala Lumpur, the Sycamores flew 80 miles to an advanced landing zone, 15 miles from Fort Brooke, in the jungle of north-eastern Pahang; thence they carried out a shuttle service to temporary landing areas, from which the S.A.S. troops went into immediate action against a group of terrorists in the Fort Brooke area.

S/L. C. R. Turner, who commands No. 194 Sqn., paid particular tribute to the squadron's flying crewmen, who broke all records for refuelling, which had to be done from four-gallon cans. Yet despite this handicap and "most trying conditions," says S/L. Turner, "the best refuelling time for one aircraft was three minutes and none took more than five."

Two soldiers of the Gloucester Regiment in Cyprus train with a Bristol Sycamore as jumping-off point in accordance with Maj-Gen. Kendrew's policy of hunting terrorist bands with small but highly efficient units of men dropped by helicopter at strategic points.

R.A.F. Britannias

IN a written Parliamentary answer the Minister of Supply, Mr. Aubrey Jones, said that the Bristol Britannias being acquired for R.A.F. Transport Command would go into squadron service during the latter part of 1958.

Vice-Admiral Mackintosh

WE regret to record that Vice-Admiral L. D. Mackintosh of Mackintosh died on March 20, aged 60, at his home, Moy Hall, Moy, Inverness-shire.

During the war he commanded the aircraft carrier H.M.S. *Eagle* when she was torpedoed and sunk in the Mediterranean, and later the fleet carriers *Indomitable*, *Victorious* and *Implacable*.

He became one of the first half-dozen men to qualify as an observer in the Fleet Air Arm (in 1921) and was one of the few admirals entitled to wear, off duty, a kilt—a privilege which he exercised.

IN BRIEF

R.N.Z.A.F. Sunderlands are to assist in collecting samples of fall-out after the "Operation Grapple" hydrogen-bomb tests in the Christmas Island area.

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The Association of Frenchmen decorated by Great Britain has invited 30 members of the R.A.F. Escaping Society to visit Paris next month during Queen Elizabeth's state visit to France.

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For the first time in the history of sporting contests between the two units, the Royal Air Force College, Cranwell, on March 16 beat the Royal Military Academy, Sandhurst, at squash. The score was 5—0.

* * * * *

A Royal Air Force memorial chapel is being dedicated this morning (March 29) at Sutton Bridge, Lincs, parish church by the Bishop of Lincoln, the Rt. Rev. Kenneth Riches. To be called St. Michael's Chapel, it will commemorate R.A.F. personnel who served at Sutton Bridge, near Spalding, and lost their lives during the last war.

Next Tuesday will see the inauguration of B.O.A.C.'s first service to the U.S. West Coast. Here is a B.O.A.C. Seven Seas at San Francisco after its recent proving flight: the Qantas steps symbolize the round-the-world Commonwealth link which will be forged.

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BLACKBUSHE ACCIDENT

THE Commissioner of the public inquiry which investigated the accident to Hermes G-ALDJ of Britavia on November 5, 1956, states in his report (published on March 7 and reviewed briefly last week): "I am unable to reach a positive conclusion about this accident." The report gives the court's conclusions as to the "possible causes." The accident occurred at night in poor visibility while the aircraft (commanded by Capt. T. Conner) was on the approach to Blackbushe at the end of a flight from Tripoli. The aircraft undershot the runway and hit a beech tree 3,617ft short of the runway threshold; it then swung sharply to port, came down among pine trees about 3,000ft away, and caught fire. Both pilots and the radio officer were killed by impact and four children (who were pushed out of emergency exits) lost their lives by fire. The remaining occupants, three crew members and 70 passengers (mostly Service families being evacuated in the Suez crisis), survived.

The possible causes given are as follows. The magnitude of the eventual departure from the glide-path (197ft below) was such that the captain could not have been indifferent to it, and that he was therefore unaware of it. If he had been watching the I.L.S. indicator or the altimeter (he had rejected G.C.A. owing to a 30 min delay), and if these were working properly and the altimeter was properly set, they must have given warning. It seemed improbable from evidence that the instruments were at fault. It was not unusual for an error of a millibar or two to be made in setting an altimeter, and this may well have occurred (1023 mb instead of 1021); but the departure from the glide-path was much more than the 60ft this represented.

The R/T. record indicated that the captain had, or believed he had, the approach lights in sight when he was still two miles from the threshold. He might have had a better indication if there had been at Blackbushe an approach lighting system more in accordance with the latest I.C.A.O. recommendations. Meteorological evidence was consistent with there being a layer of fog or very low cloud, not very dense and not evenly spread, on or near the ground. This might have caused the pilot to see the lights as being further away and at a greater distance below him than they really were.

It was probable, states the report, that the captain made one or more of the following errors: (1) He failed to set his altimeter correctly when given the QFE by R/T. (2) He gave up reference to his I.L.S. indicator before he had a sufficiently clear view of the lights. (3) He did not check his height by glancing at his altimeter. If the captain was relying on the first officer for guidance about altimeter readings the error may have been that of the first officer.

If any of these errors had been made, continues the report, the fact was probably due "at least in part" to some loss of alertness brought about by fatigue. (When the accident occurred the crew had been on duty for nearly 30 hours, including a break of 10 hours in poor rest conditions at Idris.) Among the Commissioner's recommendations are references to crew-fatigue: "The question of what regulations should be laid down for the . . . hours of duty and rest of aircraft crews is one of great importance which has been occupying the attention of the proper authorities for some time." He recommends that if any discretion is to be left to the captain, this is to be clearly stated.

The body of the report describes in some detail the evidence relating to the possible tiredness of the Hermes crew. In the voyage report written by Captain Connor (which was found in the aircraft) appeared the following extract: "We have spent six and a half hours at Malta with this blasted magneto, and we now face a duty day of 21½ hours which includes a complete night. We don't mind in this emergency, but will not tolerate such conditions indefinitely." The inquiry found that nobody was to blame for this delay, and that the faulty magneto had been properly checked at base. Furthermore, the crew's continuous duty was not to be quite so long as the captain had estimated, but was to be more than 19 hours. The captain's voyage report referred also to "extremely chaotic" conditions at Idris, which had been taken over by the R.A.F. during the Suez emergency, and to accommodation which was "the worst I have yet encountered." The inquiry report was satisfied, however, that although the rest at Idris was a poor one, this was nobody's fault and was the result of the emergency.

The question arose why the captain elected to leave Idris after a rest there of only ten hours following a duty period of over 19 hours. The relevant rules laid down by Britavia in their operations manual were as follows: (1) Normal duty hours will not be scheduled to exceed 16 hours except in cases where a higher fatigue factor would result, e.g., unsuitable night-stop facilities, etc. In these cases only duty hours of up to 20 hours are permissible at the captain's discretion. (2) The minimum rest period following 16-hour duty is 12 hours. The minimum rest period following a 20-hour duty is 16 hours, or *pro rata*.

The second paragraph did not leave any discretion to the captain, but Britavia officials had said in evidence that in abnormal circumstances they would expect the captain to exercise his discretion. As this was the company's view the captain could not be blamed for not adhering to the letter of the printed instructions.

WHEN IS AN OBSTRUCTION . . . ?

A PROPOSAL to erect a mast for I.T.V. transmissions in South Wales was the subject of a recent public inquiry held in Cardiff under the ægis of the Ministry of Town and Country Planning. It is planned to erect the mast on a site within 4½ miles of Rhoose Airport, and it would rise to a height of approximately 750ft above the level of the airfield.

A correspondent writes that local aeronautical interests are opposing the project, adding that Rhoose already suffers from the presence of a B.B.C. mast at Wenvoe, which, on a different bearing, is at a similar distance and of comparable height.

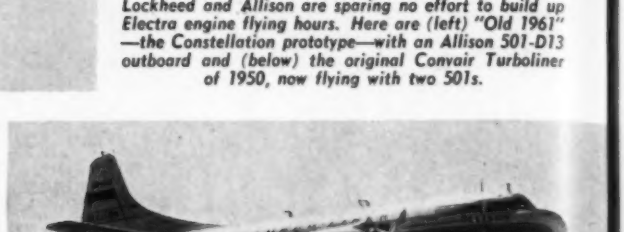
The "extraordinary attitude" of the Ministry of Transport and Civil Aviation is the subject of remark by our correspondent. "In the statement made at the inquiry," he writes, "and at a previous meeting, we had the curious exhibition of the Ministry strongly advocating the placing of an obstruction of this nature within the manoeuvring area of an international airfield."

Invited by *Flight* to comment on this allegation, a Ministry spokesman said: "The M.T.C.A. witness at the inquiry certainly did *not* advocate the placing of an obstruction within the manoeuvring area of Rhoose Airport. The witness said that the Ministry's function, before the inquiry and at the inquiry itself, was to advise whether the mast at St. Hilary Down would be an obstruction to aviation in the light of I.C.A.O. standards. The Ministry's advice was that it did not offend these standards."

VISCOUNT PRECAUTIONS

SHORTLY after the announcement of the return of B.E.A.'s Viscount 701s to service, reported in our pages last week, a decision was taken by B.E.A., Vickers and the Air Registration Board to extend the precautionary measures which followed the accident at Ringway on March 14. It was decided that the most

Lockheed and Allison are sparing no effort to build up Electra engine flying hours. Here are (left) "Old 1961"—the Constellation prototype—with an Allison 501-D13 outboard and (below) the original Convair Turboliner of 1950, now flying with two 501s.



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prudent course to take was to change all of the bolts in the flap-operating mechanism. B.E.A.'s fleet, seven of which had resumed service on the Monday following the accident, was again withdrawn for inspection. In spite of this handicap, the Corporation managed to keep services going with its new Viscount 802s and with Elizabethans and Pionairs. All but two international services and a few domestic flights were affected. Full service was resumed last week-end, although modification of all 25 Viscount 701s had not been completed.

Elsewhere in the Viscount world similar programmes of withdrawal and inspection were pursued. Following advice from Vickers, the flap-mechanism bolts were changed on all aircraft that had made more than 1,500 landings. Capital, who withdrew their Viscounts on March 19, had 90 per cent of their 60-strong fleet back in service the following day (some of their aircraft are, of course, new).

T.C.A.'s fleet was also progressively modified during the week, and in Australia the Viscount 756s of T.A.A. and 747s of Butler were similarly treated. T.A.A. completed bolt-replacement work last week-end, when spares for the last five of their fleet of 14 to be modified had been received from England.

Air France withdrew their aircraft pending arrival of spares from Vickers and they, too, hoped to have their 11-strong fleet back in service on Wednesday. Aer Lingus resumed full services last Friday after similar action.

A PLEA FOR FAIR FARES

THE I.C.A.O. symposium on airports was addressed on March 14 by Mr. Frank Robertson, chief project designer to Short Bros. and Harland. In his paper, *Design Trends for Civil Transport Aircraft*, he said there was one main goal for which everybody in the transport industry should work—cheaper world travel for people and goods.

To illustrate his point Mr. Robertson outlined the characteristics of three hypothetical short/medium-haul aircraft, each with a capacity payload of at least 20,000 lb and designed with minimum operating cost as the only object in view; speed was allowed to come at whatever it would for minimum cost. The aircraft he chose were a turboprop, a subsonic turbojet and a supersonic turbojet. (Similar turboprop and subsonic turbojet designs were analysed by Mr. Robertson in his article *The Medium Range Transport* published in *Flight* of March 8.)

Over 1,000 n.m., said Mr. Robertson, the supersonic aircraft would take off at 216,000 lb gross weight and would carry 105 passengers at 750 kt at a direct operating cost of 3.09 pence per seat-mile. It would need 2,700 yd of runway (assuming jet reversal) and would have an approach speed of 150 kt. Obviously, he said, an expensive luxury—although sheer speed might make it worthwhile for longer stages.

The subsonic jet, weighing 105,000 lb, would carry 90 passengers over a 1,000 n.m. stage at 510 kt at a direct operating cost of 1.67 pence per seat. The runway length would be 2,000 yd (assuming jet reversal) and approach speed would be about 130 kt. This, he said, looked interesting: the D.O.C. was a shade lower than that of the existing Viscount, but the larger percentage of fuel meant that the aircraft was more sensitive to load factor and world oil prices.

The third project, a turbojet, weighed only 97,000 lb but carried 100 passengers over 1,000 n.m. at 390 kt at a D.O.C. of 1.2 pence per seat. At even a conservative estimate this would permit a halfpenny per seat nautical mile to be taken off existing fares.

An examination of these aircraft for shorter stages showed that at 500 n.m. the 510 kt turbojet carried the same payload at the same operating cost as before, but if the fuselage was designed for a greater payload the economics over 1,000 n.m. would be a lot worse. The 100-passenger, 1,000-mile-stage turboprop, on the other hand, cruising at 390 kt, had a fuselage large enough to carry 120 passengers over 500 n.m. at a D.O.C. of 1.08 pence per seat nautical mile.

Mr. Robertson concluded that it was a duty of the airlines to provide fleets of turboprop aircraft operating at differential fares (with a modified international fare structure) if they were not to be accused of protecting the "selfish interests of a privileged few and obstructing the forward march of world travel facilities." The turboprop fleets could be backed up by fast, higher-priced jet travel for the man in a hurry.

He next applied his minimum cost design technique to the long-range transport, and once again he studied a turboprop, a subsonic turbojet and a supersonic turbojet. "The last," he said, "ran into a brick wall . . . I found that I could just about fly the North Atlantic at 750-800 kt with a hundred or so passengers, but the aircraft weighed 400,000 lb and needed over 4,000 yd of runway. With the payload representing but six per cent of the all-up weight and the fuel 52 per cent, I only needed to be a bit out for the payload to be no more than a verbal message delivered a few hundred miles short of Goose Bay."

His subsonic turbojet "came out rather better" than the DC-8 or 707, but the turboprop was "really thrilling"—160 passengers carried at 400 kt for a D.O.C. of 1.3 pence per seat nautical mile and needing only a 2,500 yd runway. A turboprop that was ordered now, he said, could carry five per cent more payload than the ultimate development of the turbojet, would require the same runway as the Britannia, and would operate at two-thirds of the lowest achievable turbojet cost.

The primary objectives for people concerned with air transport, Mr. Robertson concluded, were: for the travelling public to agitate loud and long for cheaper fares and against lavish expenditure on runways longer than 3,200 yd; and for aircraft operators to provide greater regularity and frequency, to order aircraft with lower operating costs, and to see that fare differentials were agreed in I.A.T.A. Speeds should be increased only for the small amount of high-priority traffic; never—unless reduced cost could be shown—for the bulk of traffic.

THE MINISTER HITS BACK

IN the House of Commons on March 18 the Minister of Transport and Civil Aviation, Mr. Harold Watkinson, answered the criticisms of the recent parliamentary select committee which inquired into the running of Britain's airports. So long as he was responsible, he said, he would put safety above any financial conditions. "I must warn the House that there is a possibility of immense development . . . A bill of at least £4m will be necessary in the reasonably near future to face the vast increase in traffic which we expect."

The select committee's comments, he said, had got "a little off the mark." He wanted to put the matter in perspective: a steady decrease in operating cost had been achieved, but this had been matched by a "very steep increase" in technical service costs. There had not been, he said, a single word in the Report about the technical aspects of aerodrome safety, and in that was to be found the complete answer to the "very considerable misunderstandings, which that Report has played some part in creating, about the finances of aerodrome operation."

Nevertheless his Ministry differed from the select committee only in matters of interpretation. There would always be a race between trying to reduce operating costs and increasing technical costs, but he would try to make the loss as little as he could.

MAGIC CARPET ON THE SCREEN

FOR three weeks from April 4 there will be shown at the Carlton Theatre in London a new film sponsored by Air India International. Entitled *The Magic Carpet*, the film lasts for half an hour and takes the passenger from London to Japan by way of Paris, Rome, Bombay and Bangkok in an Air-India Super-G Constellation.

No doubt the intention of the film is to induce those who see it to follow the same route in the care of the same company; and in this it is sure to succeed. Filmed in colour, *The Magic Carpet* was made by Connaught Films and is distributed by Exclusive Films.

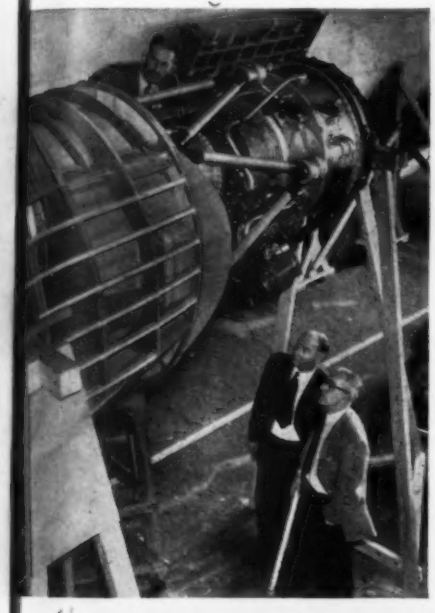
SILVER CITY ACQUIRE DRAGON AIRWAYS

IN these pages last August we recorded that the small British independent operator Dragon Airways was to operate Hunting-Clan's northern network based on Newcastle. This followed a previous move whereby Dragon had been taken over by Hunting-Clan, with the Elder Dempster Line and the Tyne Tees Shipping Co. as equal partners. That all was not well with Dragon became apparent last winter, when operations from Newcastle ceased.

A surprise announcement from the British Aviation Services Group (the parent company of Silver City Airways, Air Kruise, Britavia, Manx Airlines, and the Lancashire Aircraft Corporation) now states that the B.A.S. Group "has concluded an agreement to purchase Dragon Airways, a privately owned airline with a network of routes linking Newcastle with Norway, Holland, Germany and Northern Ireland . . . It is the intention to integrate the services previously operated by Dragon Airways with the northern division of our member company, Silver City Airways, Ltd."

The name Dragon will now disappear from the British air transport scene, and the company will henceforth be known as Silver City (Northern) Aviation, Ltd., with a new board of directors comprising initially Mr. Eoin C. Mekie as chairman and A. Cdre. G. J. Powell as managing director. Dragon's two Herons will continue in service.

This is the third B.A.S. purchase of British northern independent airlines to have taken place in the last six months. The others were Manx Airlines (September 1956) and Lancashire Aircraft Corporation (December 1956). The most interesting aspect of the latest move is the creation of a northern division of Silver City: this may well augur wider extension of the famous name.



A replica of the Rolls-Royce Tyne is here seen installed in the starboard inner nacelle of the Vanguard mock-up at Weybridge. Looking on is (lower left) Mr. E. S. Allwright, the Vickers engineer responsible; with him are his colleagues Mr. J. Hird and Mr. E. I. Davis.

(Below) More evidence of the way Convair are getting down to detail with the 880 is provided by this group of T.W.A. and Delta executives studying, with the aid of models, the medium jet's terminal characteristics.

DUTCH TRAFFIC RIGHTS IN THE U.S.A.

THERE was sharp disagreement last year between the Dutch and the Americans over new traffic rights proposed by Holland for K.L.M. in the U.S.A. (see *Flight*, October 5, 1956). New negotiations were opened in Washington on March 19; and although there is as yet no indication of their outcome, it seems almost certain that—despite the objections of PanAm and other U.S. carriers—K.L.M. will be granted traffic rights to operate from New York to Curaçao in the Dutch West Indies, together with an extension of the Amsterdam-Montreal route to either Los Angeles or Houston, and so on to Mexico.

ANTONOV'S UKRAINA

SINCE 1952 the design bureau of the Russian designer Oleg K. Antonov at Kiev has been engaged principally in the design of large turboprop freight and passenger aircraft. The first such project to be built—the AN-8 (or AN-4 in the Russian Air Force) described in our issue of August 3 last—was a high-wing machine weighing up to 88,000 lb, powered by a pair of 5,100 h.p. engines. It first flew early in 1955 and is now in production as a multi-purpose civil and military machine.

Illustrated for the first time (p. 397) is the larger civil AN-10 bearing the name Ukraina. It is powered by four 4,000 e.h.p. engines "which," say the Russians, "are more economical than the engines of the Viscount"—a claim that emphasizes the Soviet Union's serious efforts towards achieving commercial sales.

The AN-10 adheres to the high-wing layout, and makes a most instructive comparison with the still-born Vickers-Armstrongs V.870—the "might-have-been" Vanguard which was almost built for B.E.A. (sketch, *Flight* for December 9, 1955, p. 862). Like the V.870, the AN-10, in its civil passenger form at least, has a capacious fuselage of circular section. This gives great floor-width, and the aircraft must easily accommodate its announced load of 70 to 80 passengers on Aeroflot routes. In addition there should be ample room for stowage under the floor, notwithstanding the accommodation of the main bogies, and most of the accessory systems components, in the mid-section.

Following typical Russian practice, the front end has a transparent nose for the navigator, with a radar scanner under the floor and a broad cockpit immediately aft. The whole interior is pressurized, and the peak operating height on a long stage is given as 10,000m, or over 32,000ft. At the rear end is a main door on both sides and a retractable tail bumper below, to protect the unusual ventral fin. The floor slopes upwards towards the tail.

Each engine is an axial turboprop, of some 40in cowled diameter, driving a single-rotation 15ft propeller. The intakes are of the direct annular pattern, the jet-pipes exhaust straight out under the wing, and the oil coolers are mounted in large ducts on the underside of the nacelles. The AN-10 can, it is stated, take off on any three engines and fly on any two.

According to *Red Star*, the Army newspaper, the type cruises at 370 m.p.h. (This compares with the 412 m.p.h. of the V.870 weighing 101,000 lb and using four early R.B.109s of 4,000 e.h.p.). The AN-10 must suffer slightly from the great size of its fuselage; yet it is undoubtedly a machine to be watched. Everything that Mr. Antonov has said about it indicates that it will be a formidable aeroplane to match on a cost-per-ton-mile basis, and Aeroflot intend to use it on international routes. In fact, had it not been for a Soviet change of heart, the AN-10 would be seen at the Paris Salon in May and would thereafter have visited London.

BREVITIES

A B.O.A.C. Stratocruiser flew the Prime Minister, Mr. Harold Macmillan, and the Foreign Secretary, Mr. Selwyn Lloyd, to Bermuda on March 19 for their talks with President Eisenhower. The aircraft refuelled at Gander *en route*. The party were due to return on Wednesday.

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Mr. A. R. Bennett, formerly B.O.A.C.'s reservations manager, is to become sales manager U.K. He will concentrate on day-to-day administration to free Mr. M. D. Morrissey, regional sales manager U.K. and Europe, for policy planning. The new head office reservations manager will be Mr. R. J. Walden.

* * *

A reduction in rates from £25 to £17 per ton for consignments in excess of four tons has been announced by Silver City Airways on their "Roadair" services between London and Paris. The time for bulk cargoes between the two cities has been reduced from 72 hours to 48 hours.

* * *

Transcontinental, the new Argentine Convair 880 operator-to-be, has been authorized to operate from Buenos Aires to Montevideo, Sao Paulo, Rio de Janeiro, Caracas, New York, Lima, Bogota, and San Francisco. Routes to the Far East are also envisaged.

During a recent visit to Fairchild, Prince Bernhard of the Netherlands was shown round the mock-up of his country's Friendship. First American deliveries of licence-built aircraft are due in November.

CIVIL AVIATION . . .

According to Mr. I. A. Aler, K.L.M.'s president, the airline is "interested" in the Amsterdam-Tokyo polar route, though not expecting to operate over it for two or three years. The new engine overhaul shop at Schiphol will cost £1.8m and will be completed in 1958.

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Iraqi Airways' Viscount 773s will be equipped with the Smiths S.E.P.2 autopilot. Iraqi is the nineteenth operator to order this equipment.

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Mr. Raymond B. Maloy of C.A.A.'s Paris office has been appointed acting director of the C.A.A. Office of International Co-operation.

It is reported that Trans-Australia Airlines are considering the purchase of Caravelles. As reported previously, M. Jean Gelos of Sud-est has been in Australia to negotiate with the airline.

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The Russian Government have presented an Ilyushin 14 to the Shah of Persia. Its equipment includes a bath.

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Pan American are now considering the sale of their share in Panagra to Braniff Airways in exchange for new traffic rights in South America.

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An agreement under which K.L.M. and Yugoslav Air Transport will operate a regular service between Belgrade and Amsterdam was signed in Belgrade on March 13.

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The Secretary of State for Scotland is reported to be considering the suitability of the Twin Pioneer for ambulance purposes in the Scottish Isles.

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Yeadon Aviation, Ltd., are seeking permission to erect a new passenger terminal and to re-site the airport's air traffic control tower at the top of the main hangar.

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Lufttransport Union, the private German airline, have purchased two Vikings, a Bristol Freighter Mk 21, and a Dove. Their fleet now consists of five Vikings, one Freighter, one Dove and one Cessna 310.

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Philippine Airlines will put two Viscounts on the Hong Kong-Manila route on June 1. A Hong Kong Airways Hong Kong-Tokyo service will begin on the same day, when Northwest Airlines will suspend their present service.

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It is reported from Ceylon that Mr. Gerard d'Erlanger, chairman of B.O.A.C., was "not at all impressed" by Ratmalana Airport, particularly with regard to night landing equipment and handling facilities. The suitability of the airport for the Britannia is now under review; the aircraft called there on a proving flight earlier this month.

DE-FROSTING PARKED AIRCRAFT

THE hazards of attempting to fly aircraft which have been parked in the open in sub-zero temperatures are well known. Ice on wings and control surfaces can cause dangerous loss of lift, and special de-frosting precautions have to be adopted before take-off.

Conventional devices for ground de-frosting usually take the form of a small pump which dispenses cold de-icing fluid from a drum by means of a hose and spray, a method which does not always make the most economical use of the fluid, and which is often inadequate for large aircraft because of the capacity- and mobility-limitations of the small container.

Winter conditions at London Airport during the early days of 1955 were so intense that existing de-frosting methods proved ineffective, and British European Airways co-operated with Kilfrost, Ltd., in evolving a new technique. The basis of this was the spraying of frozen aircraft with *hot* fluid—a new compound developed by Kilfrost in conjunction with B.E.A. and known as D.C.2.

Rollason Aerocessories, Ltd., of Croydon Airport, were next brought in, and B.E.A. placed an order for the development of a scheme. The result is a compact self-contained mobile unit (see photograph) in which the Ministry of Supply have had an interest also—in particular for the de-frosting of R.A.F. V-bombers.

The Kilfrost D.C.2 liquid concerned is a firm gel at normal temperatures, and is easily melted for spraying-on hot—at temperatures of between 40 deg C and 80 deg C. About half an hour after spraying the liquid gels again, forming on the surfaces of the aircraft an evenly spread film which inhibits ice formation. It is claimed that D.C.2 applied this way provides much more efficient inhibition, and for a considerably longer period, than do conventional fluids.

For the actual removal of frost, snow or ice, the D.C.2 compound is dissolved in water to a concentration of 20 per cent (stronger if conditions demand) and is sprayed onto the aircraft at a temperature of about 65 deg C. Refreezing is prevented by the presence of the compound, and tests have shown, it is claimed, that the treatment rapidly and economically removes frozen deposits. Treatment can be followed by further application of undiluted gel if a long "hold-over" period is required.

An incidental but important advantage of preheating the fluid is said to be the economy in consumption which is attainable. Tests showed that a hot solution containing 20 per cent D.C.2 and 80 per cent water was considerably more efficient in removing frozen deposits than an equal quantity of cold, undiluted liquid.

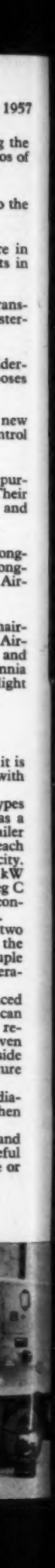
The current winter has been mild, but the effectiveness of the new method has twice been demonstrated. On each occasion, it is stated, the only aircraft which took off were those sprayed with Kilfrost D.C.2.

The unit shown in the photograph is one of seven prototypes designed and built for use by Bomber Command. Known as a Mobile De-icing Plant, it comprises a 16ft-long four-wheel trailer chassis, on which are mounted two large liquid-containers, each of 500 gal capacity, and one small container of 100 gal capacity. The two 500-gal containers are each fitted with three 30 kW immersion heaters which heat the liquid from 10 deg C to 90 deg C in approximately 2½ hours. Temperature is thermostatically controlled at 90 deg C. The plant is totally enclosed and lagged.

The main pump is driven by a petrol engine, and there are two hose-reels carrying 70ft lengths of hose for connection to the sprays. The spray "lances" are 14ft long and have a quadruple spraying head. They embody a temperature gauge for the operator's use.

The plant has catwalks, a rear platform and conveniently placed grip handles. All controls are so designed that the operator can use them while wearing heavy gloves. The containers are replenished with de-frosting fluid by means of an electrically-driven suction pump housed beneath the near side catwalk. On the side of each 500-gal container are a liquid-level indicator, temperature gauge and controlling thermostat.

The containers are also fitted with a pressure-operated diaphragm switch which automatically disconnects the heaters when the fluid falls to a level lower than 1in above the elements.

Following a recent series of initial trials at Bomber Command units, it is already apparent that the plant will have a useful secondary function—that of aircraft-cleaning, using Stripolene or other detergents.

The Rollason mobile de-icing plant, described above.